In this issue: Automation—Machining Plastics—Training

TOOLING and PRODUCTION

T.P.

MORE THAN EVER! Putnam designers are putting their years of specialized experience to work in developing many new end mills, including the famous Putnam Postiv-Lok. They're working overtime to meet demands of many new applications requiring sound end mill design. See Putnam for end mills with quality performance.

PUTNAM

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There's an A-L Tool Steel to do each job *best*

The Allegheny Ludlum Tool Steel family includes 37 principal types, covering the high speed, hot work, shock resisting, cold die, and carbon and low alloy steel fields. Let us help you find the best answer to *any* problem that occurs in your production or use of cutting and forming tools.

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This 72-page catalog lists the stocks of A-L High Speed and Tool Steels which are constantly maintained in each of 18 warehouses, located at convenient points from coast to coast. In compact, easy-to-follow style, the book gives a complete stock picture, nationwide, of the 15 most widely used types of these steels—each in a full range of standard shapes and sizes—and also includes data on stocks of drill rod, tool bits and Carmet carbide metal blanks and tools.

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W&D 3528 B

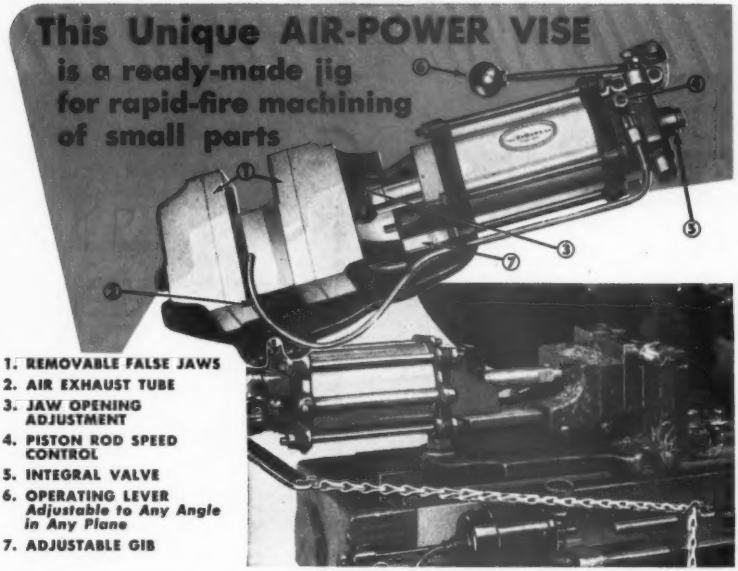
For complete **MODERN** Tooling, call

Allegheny Ludlum

AL
FINE TOOL STEELS
SINCE 1854

This Unique AIR-POWER VISE

is a ready-made jig for rapid-fire machining of small parts



1. REMOVABLE FALSE JAWS
2. AIR EXHAUST TUBE
3. JAW OPENING ADJUSTMENT
4. PISTON ROD SPEED CONTROL
5. INTEGRAL VALVE
6. OPERATING LEVER *Adjustable to Any Angle in Any Plane*
7. ADJUSTABLE GIB

Machine the soft false jaws to fit the part. Open and close the jaws automatically. Eject the part with the exhaust air.

The Bellows CV40-B Air Vise is a versatile tool around the shop. Mount it on a drill press table, or milling machine bed; machine the soft false jaws to fit the part; synchronize the opening and closing of the vise jaws with the movement of the machine . . . and you'll increase production as much as 50%.
Or use it as a bench vise in light assembly work. Operate it by foot if you wish both hands of the operator free; or arrange it with two-hand safety controls. Let the exhaust air eject the part. Even the most inexperienced operator will get fast production, safely.

No extra valves to buy. Operating valve and speed controls are built-in. Requires only one air connection which can be flexible hose.

JAW WIDTH: All models 4".

JAW OPENING: All models adjustable to 2½".

Available with either the built-in manually operated valve, as illustrated, or the built-in ELECTROAIRE* valve for full electrical control.

Clamping Pressure: CV40-B5 — Five times applied air pressure.
CV40-B10 — Ten times applied air pressure.

1265

Write for Bulletin 761. See how Bellows "Controlled-Air-Power" Work Holding and Clamping Devices will fit in your production. Address: Dept. TDJ 751, The Bellows Co., Akron 9, Ohio.
*Trade Mark Registered. Patent applied for.

The Bellows Co.
ESTABLISHED 1911
AKRON 9, OHIO

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The Magazine of

TOOLING and PRODUCTION

TOOL & DIE JOURNAL

1975 LEE ROAD • CLEVELAND 18, OHIO

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These men, from whom emanate recommendations, requisitions and orders for needed materials, tools, equipment and accessories, comprise the Cycles of Buying Influence within their respective plants—CBI—and it is they who constitute TOOLING and PRODUCTION'S ever-vital reader circulation.

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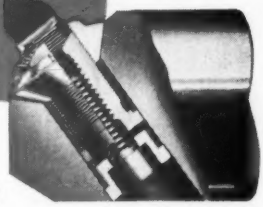
MICROBORE
by DeVlieg

Special Boring Bars

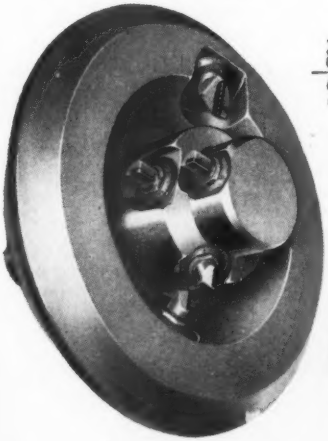
FOR PRECISION WORK
EQUIPPED WITH STANDARD MICROBORE TOOLS

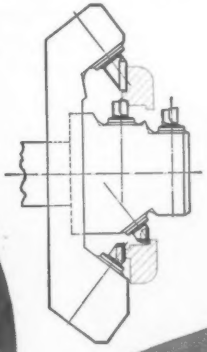
BORING ●
TURNING ●
FACING ■



Each tool independently adjusted by proven micrometer, vernier principle.

Illustration shows a special tool used in boring and turning a bearing housing for farm implements.





There is a Microbore representative in your area who will be pleased to call on you for further consultation.

ILLUSTRATED CATALOG MAILED ON REQUEST

DeVLIEG MICROBORE COMPANY
480 FAIR AVENUE
FERNDALE 20, MICHIGAN, U.S.A.

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Photos courtesy Rex Engineering Company.

These television chassis are produced from blanks sheared on Cincinnati Shears. They were formed, punched and notched on Cincinnati Press Brakes.

Blanks for a television chassis must be accurate in size, straight sided and square, for simple, rapid gauging in progressive operations.

Cincinnati Shears produce these and other blanks—without costly blanking dies—with speed and economy—to a plus or minus .005″ tolerance. Various size blanks are sheared easily and quickly by changing the setting of the gauges.

Accurate blanks from Cincinnati Shears make forming, punching, and assembly operations easy and profitable.

Cincinnati Shears and Cincinnati Press Brakes are a team that brings quality of product with economy.

Write for Catalog S-5, covering the full line of Cincinnati Shears—the shears of accuracy.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS SHEARS BRAKES

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

Tiny holes? . . . . . Easy!

Accurate holes? . . . . . Easy!

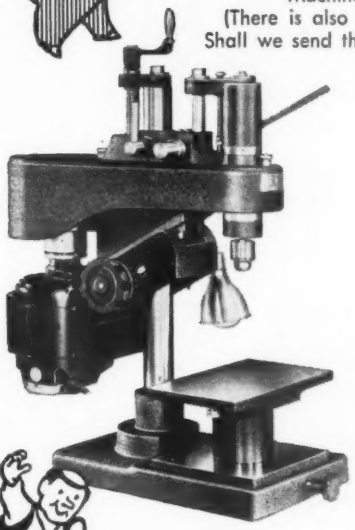
Holes on production schedules? . . . . . Easy!

***Tiny, accurate* holes on *production schedules*? . . . WOW!**

Hamilton Drilling Machines can do it!
And withdraw the drill undamaged
from hole after hole after hole!

LEARN HOW!

Write for the series of Hamilton Drilling
Machine Bulletins and Price Lists.
(There is also a companion Tapping Machine.
Shall we send that bulletin along with the others?)



Shown here is the Hamilton Varimatic, Super Sensitive, Variable Speed, Small Hole Drilling Machine, one of four models, each particularly adapted to the work for which intended, all equally precise.

THE *Hamilton* TOOL COMPANY

832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

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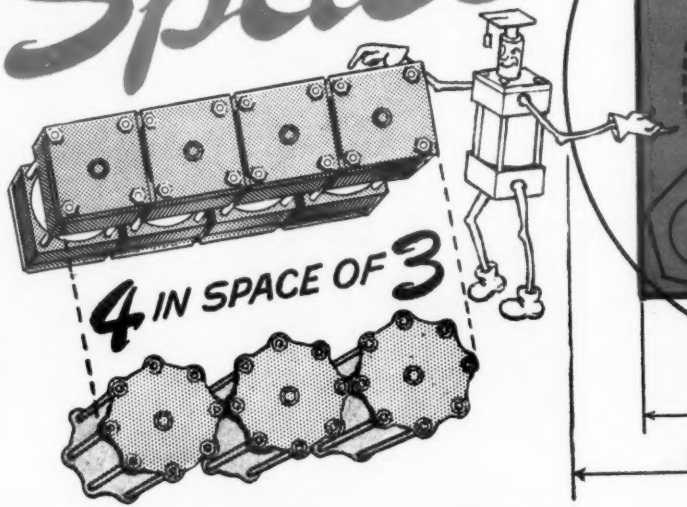
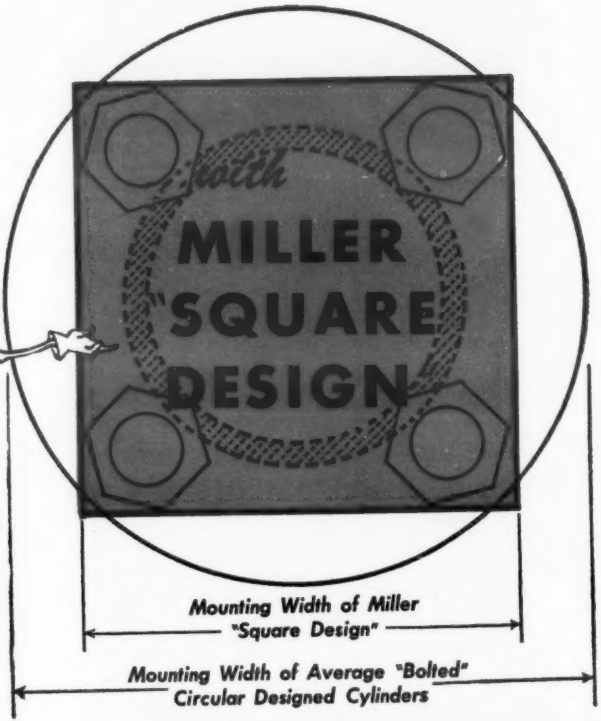
PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

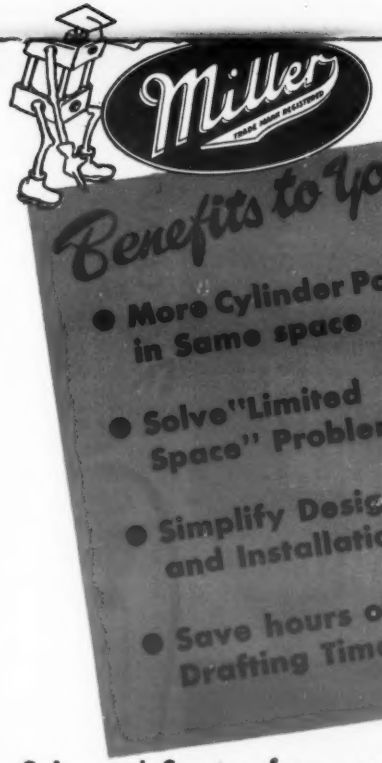
Save Space





Air and Hydraulic CYLINDERS

Air and Hydraulic CYLINDERS . . .


Miller
Benefits to You!
● More Cylinder Power in Same space
● Solve "Limited Space" Problems
● Simplify Designing and Installation
● Save hours of Drafting Time

The SQUARE DESIGN of Miller Cylinders saves up to 25% of mounting space, permitting more cylinder power in the same space and easier, more convenient installation in "tight spots." Thus, in many cases, machines and equipment can be designed more compact and less costly by using Miller Cylinders. Hours of drafting time can be saved — as only a few straight lines show any view on drawings.

The illustration at upper left shows graphically how *four* Miller Cylinders can be mounted, bore for bore, in the same space required for *three* average "bolted" circular designed cylinders. Some Miller bore sizes permit even greater space-savings.

Other important *standard* features of all Miller Cylinders include: solid steel heads, caps and mountings, hard chrome plated piston rods, dirt wiper seals, and other "quality" features as shown in illustrated bulletins sent FREE on request. Remember, too, that Miller Hydraulic Cylinders (2000-3000 psi) meet the J. I. C. Hydraulic Standards.

Write for illustrated cylinder bulletins A-105 and H-104

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

MILLER MOTOR COMPANY

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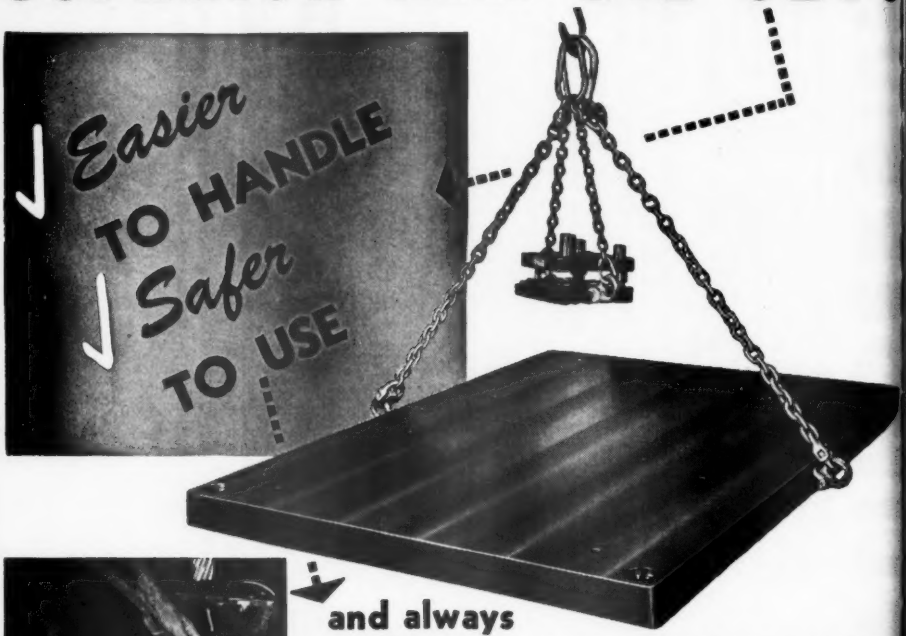
SEE ADVERTISERS INDEX, PAGE 180, FOR KEY NUMBERS

SUPERIOR *ALL-STEEL* DIE SETS



and always SUPERIOR IN PERFORMANCE

Superior All Steel Die Sets have Exclusive Design Features that make them the No. 1 Set in the field today. Superior's Lock-Jaw Lifting Device and E-Z Lift Sling Chain makes it possible to move Superior Die Sets of any size or weight . . . for any distance, in any direction (illustration above). Superior's Safety Flange safeguards against crushed fingers . . . acts as a connecting link between die set proper and lifting device (illustration left). Superior All Steel Die Sets are carefully processed to meet individual job specifications . . . your guarantee of the finest in performance. Yes, with Superior you get a **Superior Die Set,** in Less Time, at No Greater Cost. Investigate Superior All Steel Die Sets, Today.

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Free CATALOG

with complete information on Superior All Steel Die Sets and Equipment will be sent to you upon request. Write for your copy of Bulletin No. 850 today.

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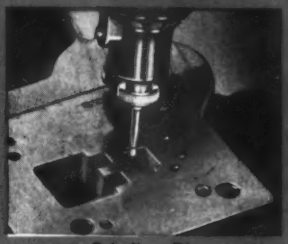
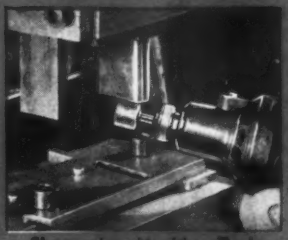
Marking Parts



Grinding Dies



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Burring Machine Parts

PAYS FOR ITSELF ON "HARD-TO-GET-AT" JOBS

DREMEL

Electric

MOTO-TOOL

APPROX. 27,000 R.P.M.

"THE POCKET-SIZE MACHINE SHOP"

Dremel Moto-Tools are time-tested—have been widely used in industry for over fifteen years. A veteran of World War II, Moto-Tool served in war plants and at military maintenance bases throughout the world. Thousands of these mighty midgets helped to make the atomic bomb—were used to establish production records in defense industries during the last war. Hundreds of toolroom and production line operations, such as polishing and grinding dies, burring parts, marking tools, sharpening cutters, touch up jobs, etc. are accomplished in seconds, **without tearing down "set-ups."** Moto-Tool is sturdily constructed for long lasting industrial service. Weighs only 13 oz.— dynamically balanced for vibrationless operation.

MOTO-TOOL KIT NO. 2 contains 23 accessories, including high-speed steel cutters and Model 2 Moto-Tool in natural finish hardwood case $23.50

MOTO-TOOL No. 2, with one emery wheel point $16.50

Dremel HIGH-SPEED STEEL CUTTERS and balanced wheel points are available for all makes of hand grinding tools.

Write For Industrial Catalog

DREMEL MFG. CO. Dept. 521-G **RACINE, WIS.** U.S.A.

FULL SPEED AHEAD

IS THE PRESENT-DAY DEMAND

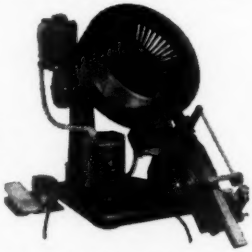
and You Can Command It With

D.P.S. MOTORIZED Selective Feeding HOPPER UNITS

Hopper feeding 30 caliber shell discs, concave side up, to press for drawing operations.

Modern production methods demand more speed and accuracy in the selection and feeding of parts than can be accomplished by hand . . . Our 25 years experience as pioneers in the assembly field enables us to ably meet this demand with the D.P.S. Motorized Hopper Units, the outstanding selective feeding devices with which production parts of a wide variety are selected, oriented and fed in a given position for primary and secondary operations . . . They are a completely self-contained unit, including drive and feed track. They are easily adaptable to presses, centerless grinders, thread rolling and slotting machines, also special machines... Six sizes, 8", 10", 12", 16", 24" and 30" diameters for handling various sizes of parts. No matter what your feeding problem is, we can meet your requirements. Designers of special equipment will also be interested.

Sixteen-inch hopper mounted on tapping machine equipped with air-operated dial—completely automatic operation.



Counting and feeding hopper with adjustable escapement to accommodate varying quantities.

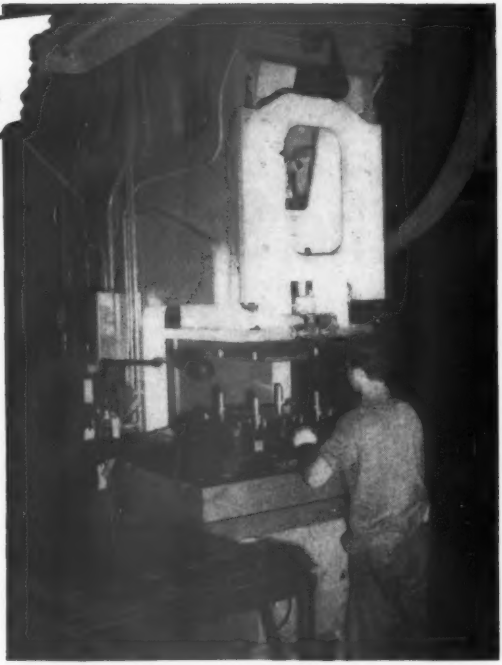
Send for further details, also information about D.P.S. Power Screwdrivers, Nut Drivers and Special Assembling Machines.

DETROIT POWER SCREWDRIVER CO.

2827 W. FORT ST. DETROIT 16, MICHIGAN

Can you match these production figures?

THIS Verson OPEN BACK GAP PRESS blanks 30 adding machine side frames per minute!



With this Verson Press, the Victor Adding Machine Company, Chicago, is able to combine high production with extreme versatility. In addition to blanking 30 side frames per minute, the same press is also used for blanking and forming base panels and blanking, forming and piercing keyboard panels at high rates.

The Verson Press is a 150 ton No. 8½ F Open Back Gap Press equipped with 28" x 30" flanged slide and a Verson pneumatic die cushion. The No. 8½ F is part of the Verson line of open back gap presses that includes upright, inclinable and permanently inclined models with normal operating capacities of 90, 105, 125, 150 and 180 tons.

We will be happy to send you further information on efficient, versatile Verson Open Back Gap Presses. Write for descriptive literature.

Originators and Pioneers of Allsteel Stamping Press Construction

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING
DIE CUSHIONS • COMPRESSION AND TRANSFER MOLDING PRESSES

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Here's PREPAREDNESS of the Soundest Kind

3 Brown & Sharpe Machines

that equip you to mill small and medium-sized parts fast, accurately, economically

The greatest service you can render to your company today, is to make sure that your plant facilities are prepared to meet increasing demands for accurately-made small and medium-sized parts at low cost.

That is why it will pay you to investigate the three manufacturing-type Brown & Sharpe Milling Machines shown here. They are specifically designed for mass producing milled parts, with uniformly high precision and minimum demand on the operator's time and attention. Adapted to an almost endless variety of jobs, they assure you continuing big returns on a moderate capital investment. Write for detailed catalog and specifications. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

No. 12 PLAIN MILLING MACHINE
3 h.p. Spindle Drive

Complete electrical control of all power movements gives unusually precise, smooth performance with outstanding ease and flexibility. Wide variety of automatic cycles obtainable, with time-saving dual feed rate. Ample capacity for majority of medium-sized work. Climb milling in either direction.

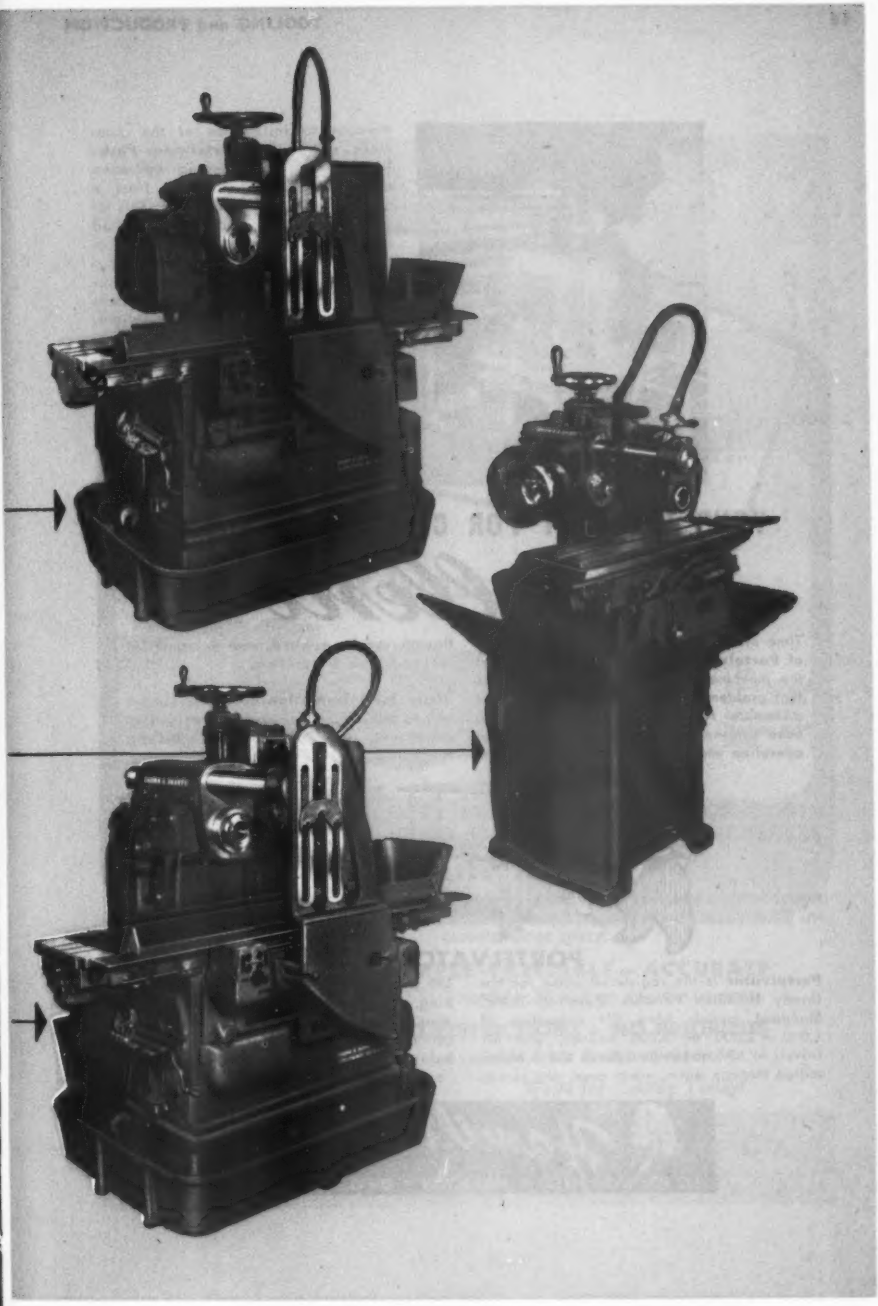
No. 000 PLAIN MILLING MACHINE
½ h.p. Spindle Drive

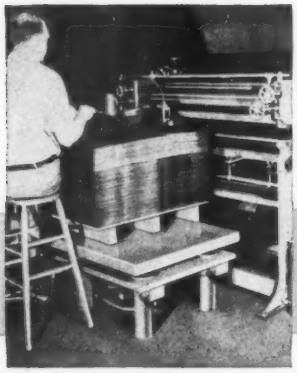
For economical, fast production of small pieces such as parts for firearms, radios, etc. Automatic cycle and minimum fatigue for operator afford uniform production rate. Uniform feed gives long cutter life.

No. 12 PLAIN MILLING MACHINE
7½ h.p. Spindle Drive

Same features and advantages as the 3 h.p. model, but powered for heavier cuts, including many moderate-sized carbide milling jobs.

Brown & Sharpe B&S





Previous to installation of the automatic, self-leveling **Portelvator Packlifter,** the sheet feeding operation shown here was performed from a standard four-wheel floor truck. This involved stooping and lifting, and resulted in unused machine capacity. Application of **Portelvator** Material Positioning Equipment increased daily production to such extent that installations were made at 6 additional locations.

YOUR PROSPECT FOR COST REDUCTION IS

Excellent

Time after time after time, the application of **Portelvator** to material positioning at the machine has resulted in such savings that problems, which seemed to have only a remote relationship to the operation, have vanished. If you have one machining operation where mechanical material positioning can be applied, your prospect for cost reduction is excellent.

Write for information about the easiest way to replace brawn, your most expensive component. Ask for our free Bulletin No. P-503.

PORTELVATOR ®

Portelvator is the registered name for the Handy Hamilton Portable Elevating Table. Standard models have lift capacities of 1,000 — 2,000 or 5,000 pounds, and lift travels to 58" above floor level. Lift is transmitted through worm, worm gear, and screw. Lift principle removes all possibility of tipping, slipping or settling under the load. Modified designs, with various power applications and controls, are used throughout industry for lifting and leveling safely and "as planned".

THE *Hamilton* TOOL COMPANY

832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

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Dickerman

AUTOMATIC PUNCH PRESS FEEDS

Can triple the size of your press room!

go after larger contracts

This Rol-Di-Feed is especially adapted to feeding strip stock.

HERE'S HOW!

GREATLY REDUCED OPERATOR COSTS
UP TO 500% PRODUCTION INCREASES

ENABLES YOU

to handle tremendous volumes of production in your press rooms without an inch of increased floor space!

SIMPLE — RELIABLE — ACCURATE

7 models. Mount on any die or press.

NO RESTRICTIONS • NO PRIORITIES

Available from dealer stocks now.

Write for Catalog Today!

Will feed metal without scratching or marring, also plastic, fibre, etc.

•

Gives exceptionally long service. Up to 25,000,000 cycles without maintenance costs or expense.

•

Installation pays for itself in a matter of days in most cases.

H. E. DICKERMAN Manufacturing Co.

323-722 ALBANY STREET, SPRINGFIELD, MASS.

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

POSITIVE ALIGNMENT
in R-B*
Interchangeable
Punches and
Dies
*Richard Brothers

*Richard Brothers

A Stillson wrench might force rotation of R-B punches or dies, but the heaviest of press usage will ***never*** budge them once they're locked in position. These time-and-money savers are easy to install and remove: just a push, a twist and "Click," the ball locks in the recess on the punch or die button.

The R-B ball lock ***keeps*** punches and dies perfectly aligned—both vertically and radially. Its positive alignment assures trouble-free piercing of even the most complex shapes. Why not send today for the whole story? **Allied Products Corporation, Richard Brothers Div.**

CHECK THESE OTHER R-B FEATURES, *TOO!*

- ***Reduce press down-time for replacements***
- ***Save design and assembly time***
- ***Fast delivery on wide range of sizes and types***
- ***Prompt service on "specials"***

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Also Produced in
ALLIED'S FOUR PLANTS
HARDENED AND PRECISION GROUND PARTS • STANDARD CAP SCREWS • SPECIAL COLD FORGED PARTS • SHEET METAL DIES • ALLITE DIES CAST OF ZINC ALLOY • JIGS • FIXTURES

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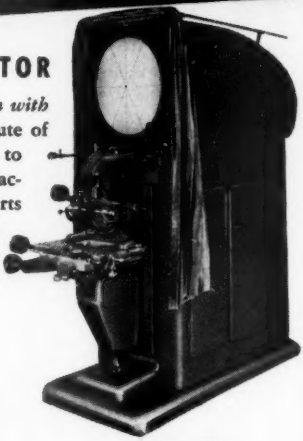
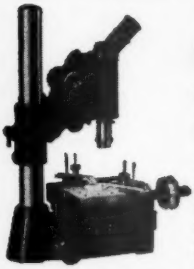
FOUR OPTICAL AIDS to help you SAVE MATERIAL and MAN-HOURS!

1 CONTOUR MEASURING PROJECTOR



Save time and money—*more accurate measurements than with any other projector!* Angular measurements to ±1 minute of arc, with protractor screen. Direct linear measurements to ±.0001" over 4" x 6" range, with cross slide stage. Spot inaccuracies quickly and simply. Compare production-run parts directly with a *traced outline* of the projected image of the master part, or with a large scale drawing superimposed on the screen. *Catalog* D-27.



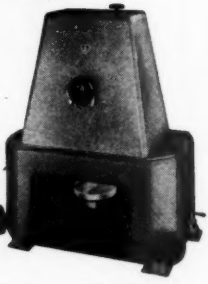
2 TOOLMAKERS' MICROSCOPE

Linear measurements to ±.0001"; angular measurements to ±1 minute of arc, with protractor eyepiece. Simple, quick measurement of opaque and transparent objects of any contour. *Catalog* D-22.

3 STEREOSCOPIC WIDE FIELD MICROSCOPES

Sharp, three-dimensional, unreversed images. Speed and accuracy in small parts assembly operations, inspection of tools and finished parts, and precision machining of small parts. 15 models, widely used in industry. *Catalog* D-15.

4 *New* PARA-PLANE GAGES



Now you can have "laboratory" accuracy of 0.000001" in the determination of flatness and parallelism of reflecting surfaces... with production-line *simplicity* and *speed.* So simple that an unskilled operator can take measurements after a few minutes of instruction. Two sizes available. *Bulletin* D-224.

WRITE for full information on these four important optical aids, to help you save time and money. You may be paying many times over their cost in lost time and rejects. Bausch & Lomb Optical Co., 798-7 St. Paul Street, Rochester 2, N. Y.

B&L Bausch & Lomb *Quality Control* Instruments

the ***HIGH POINT*** *in Modern High Speed Steels!*

VASCO SUPREME

When you have high production requirements or materials to cut that are difficult to machine, you'll do better with SUPREME! Let us have our experts guide you in its use.

SUPREME Performance Facts

In **boring** spring steel locomotive piston rings: 15 times longer wear than 18-4-1 . . . **Turning** SAE 4145 steel: lasts 18 times longer than cast alloy . . . **Facing** heat-treated spring steel wear plates: 24 times better than previous best tool steel . . . **Broaching** gray iron: 5 times the former production on first grind, 30 times longer wear on second grind . . . **Shearing** pre-worked carbon steel: 16 times the performance of cobalt high speed steel formerly used. These few out of hundreds of similar filed reports will be gladly detailed to you on request.

NOTE: Vasco Supreme A—a Class A steel—is not restricted by Limitation Order M-30.

Vasco Supreme and Vasco Supreme A steels developed by Vanadium-Alloys Steel Co. are fully covered by U.S. Patents 2174285 and 2174286. Beware of unlicensed imitations.

Vanadium-Alloys
STEEL COMPANY
LATROBE, PA.

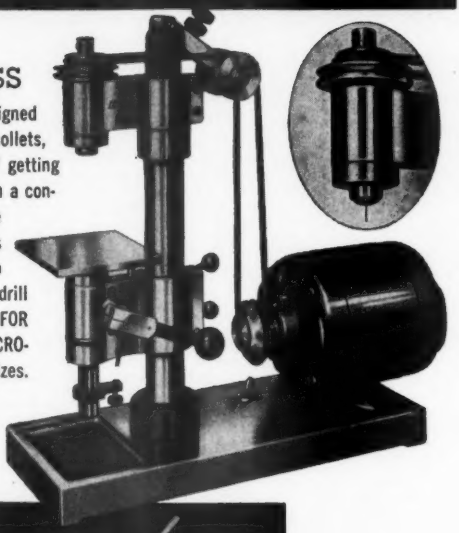
COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL COMPANY

LEVIN® TOOLS ARE DESIGNED
TO MAKE DELICATE PRECISION EASIER

MICRO-DRILL PRESS

The Levin Micro-Drill Press is designed to hold small drills in precision collets, thus overcoming the difficulty of getting a drill to run true as when held in a conventional drill chuck. The absence of a sliding quill guarantees maximum sensitivity with fingertip control. A mounted ⅛" capacity drill chuck can also be used. WRITE FOR BULLETIN H DESCRIBING THE MICRO-DRILL PRESS and listing collet sizes.

for drilling holes as small as .002"



Precision jewelers lathes for fine instrument work and second operations

SEND FOR CATALOG E DESCRIBING LATHES AND ACCESSORIES

COMPLETE CATALOG illustrates and describes full line of accessories: Compound Slide Rests, Grinding, Milling and Screw Cutting Attachments, Cross Slide, Collet Closer and other useful items.

LOUIS LEVIN & SON INC., 782 E. PICO BLVD., LOS ANGELES

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CYLINDRICAL SHAPE RADIUS END
HAND CUT STYLE "B"
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NICHOLSON FILE COMPANY
NICHOLSON
CATALOG No. 4
NICHOLSON FILE COMPANY

(Actual page size 8½" x 11")

You need this comprehensive and informative new catalog. Makes it easy to select what you need — both visually (from actual-size illustrations) and by printed specifications and with corresponding key numbers. Contains:

228 individual Nicholson Rotaries **embracing all popular shapes and head sizes in Hand Cut Hi-Speed Steel, Ground Burs Hi-Speed Steel, Ground Burs Carbide; in both ¼" and ⅛" shank sizes.**

8 kit assortments in 10 to 18 shapes.

4 illuminating pages on choosing and using Rotaries.

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95 Acorn St., Providence 1, R. I. (In Canada, Port Hope, Ont.)

NICHOLSON U.S.A.

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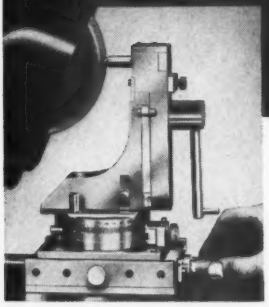
More Production per Man Hour

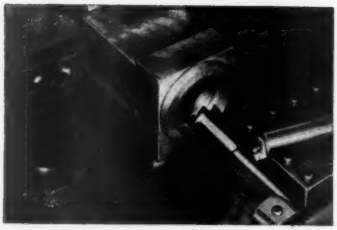
with Machine Shop TIME SAVERS

by J&S



J & S "Fluidmotion" RADII and ANGLE DRESSERS dress entire angle-radius-angle profile in one continuous motion—with one easy set-up! Automatic centering, dustproof and chatterless, high-carbon, high-chrome steel construction. Dresses wheels up to 20" diameter—easily adaptable to all surface and cylindrical grinders, with J & S fixtures.

J & S KOALA "Circular" CUTTING TOOLS. New or re-sharpened cutters inserted in same shank without re-setting machine or stops—each accurately repeats original set-up position! Easy to re-grind, low-priced, simple. Major uses: Internal—boring, facing, threading, forming; External—turning, facing, forming, threading. Photo shows typical deep boring, boring and internal facing operation, external facing and turning. 12" Boring Bar removed to show carbide head after numerous re-grinds.



J & S "Down-Hold" VISE JAWS and "Attachable" PARALLELS, used with regular vises, save 25% to 75% on loading time! VISE JAWS force work-piece down—"stops" provide accurate position. Eliminate hammering, feeler gauges, allow repetitive operation. PARALLELS snap into place, are forced down so chips can't get under them. Eliminate wiping vise and parallels after each operation. Both Vise Jaws and Parallels easily attached to any type and size machine vise.

Also: J & S "All-Purpose" JAW CLAMPS (see center photo) for quicker set-ups, better grip; J & S Form Grinding Service ---special tools to specifications.

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J&S TOOL CO., INC.

475 Main Street, East Orange, N. J.

Representatives in Principal Cities

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ON ANY ORDER

Ex-Cell-O Carries More Than 300,000 Drill Jig Bushings in Stock!
In addition to accuracy and long life, you get immediate delivery on any order of any size when you specify Ex-Cell-O Drill Jig Bushings. That is because Ex-Cell-O stocks more than 300,000 bushings —one of the largest and most varied supplies in the world. For list of standard styles quickly available, write for free copy of Ex-Cell-O Bulletin 35371.
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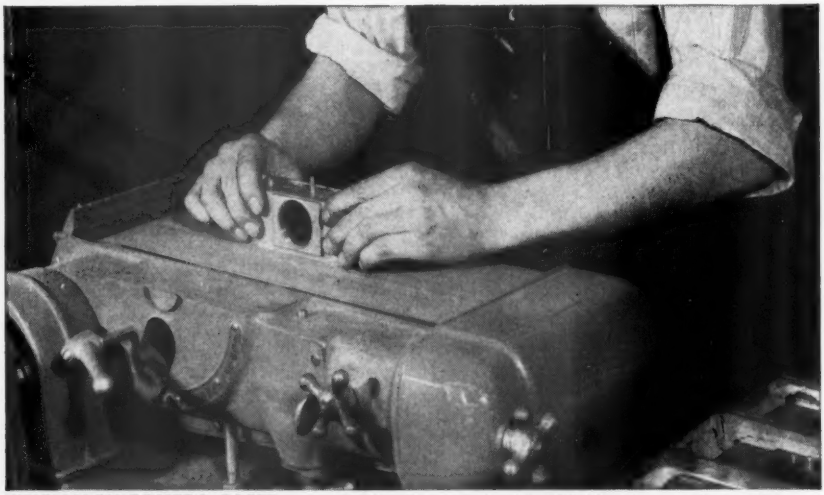

ZINC-ALLOY CAMERA CASES are ground satin-smooth with 3M Abrasives at Clarus Camera Co., Minneapolis, Minn.

How the right abrasive boosted belt life 600%

Loading caused by soft metals was limiting production to 40 units per belt at Clarus Camera Co. until the 3M representative recommended the *right* abrasive for the job. Now production has jumped to 240 units per belt!

Are *you* getting maximum production from *your* present abrasives? A 3M representative will be glad to show you how to cut your finishing time, get a smoother surface at a lower cost.

As an additional service, free analysis of your grinding problem is offered at any one of our 13 demonstration rooms—each located in a major industrial area. A 3M Methods Engineer will be glad to help you. Use coupon below.

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St. Paul 6, Minn.

☐ Please have a 3M Methods Engineer call.

☐ Please send copy of new "Step Up Production" booklet explaining the 3M Method of Grinding and Finishing.

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3M ABRASIVE BELTS

Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Adhesives. General Export: Durex Abrasives Corp., New Rochelle, N. Y. In Canada: Canadian Durex Abrasives Ltd., Brantford, Ontario.

MOORE SPECIAL TOOL COMPANY

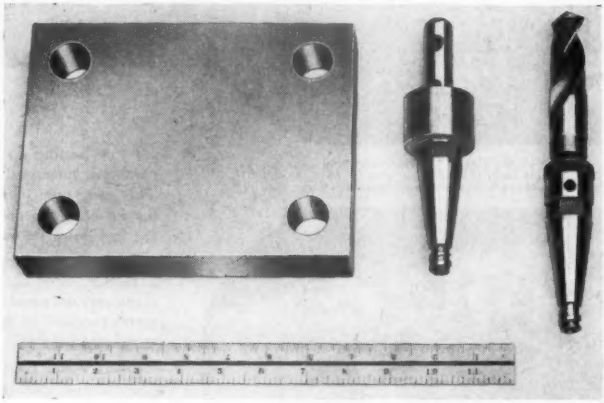
Hole Location Practices

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Company, Inc. 726 Union Avenue, Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Die Flippers, Motorized Centers and a complete line of Hole Location Accessories.

4 HOLES to ± .0002" in 8 MINUTES

How would you do it?

Sixteen of these pieces were needed. The four 1" holes are 1⅛" deep—with location and size tolerance ± .0002". It would be impossible to obtain such accuracy using a drill jig—and impractical on this short run. Then how could you locate, drill, bore and check the four holes in only 8 minutes?



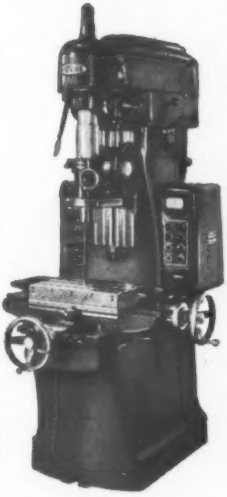
HERE'S HOW:

Using a No. 2 Moore Jig Borer with one $\frac{31}{64}$" drill and one cut carbide bit, all sixteen pieces (64 holes) were finished in 2 hours and 38 minutes!

FIVE SIMPLE STEPS:

1. Load piece (no fixture needed)	30 sec.
2. Locate and drill 4 holes with $\frac{31}{64}$" drill at 800 RPM	240 sec.
3. Bore holes with carbide bit at 1600 RPM	120 sec.
4. Check last hole and reset bit for next piece	60 sec.
5. Unload	30 sec.
Total time per piece	480 sec. or 8 min.
Total for 16 pieces (including 30 min. set-up time)	2 hrs. 38. min.

Why make a costly drill jig for those short production runs—or worry about keeping work within close tolerances? The Moore Jig Borer is a necessity in the toolroom; let it help you on tough production jobs, too.



Only tools used on this Jig Borer production job were drill and carbide bit shown.

Have You Bought Your Copy?

Over 7,500 copies of "Precision Hole Location" have been sold to date. Available at special price of $3 in U.S.A.; $3.50 outside U.S.A. 448 pages, over 400 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Send check or money order to Moore Special Tool Co., Inc., Bridgeport 7, Conn.

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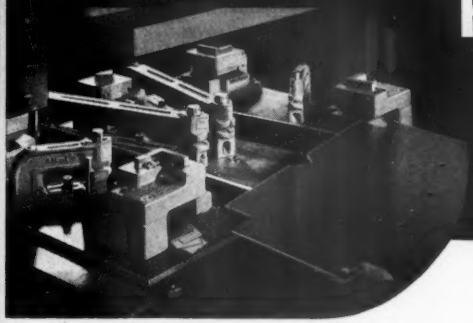
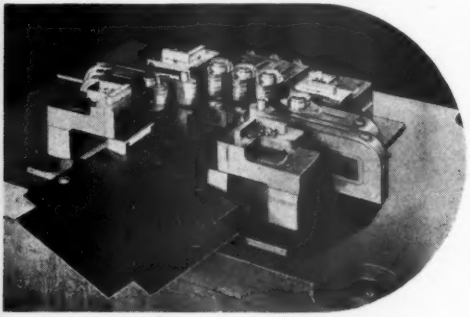
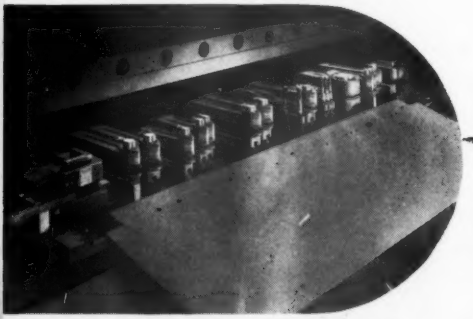
How WALES UNITS punch and notch simpler and quicker



A template set-up of Wales Type "BL" Hole Punching Units and Type "N" Notching Units in a stamping press for punching and notching in the same operation as shown in the work in foreground.



Another typical set-up of Wales Hole Punching and Notching Units mounted on the template outside the press and slid onto the press bed ready to operate with the first stroke of the press ram.



Illustrating a combination set-up of Wales Notching and Hole Punching Units on a press brake set-up. Note that straight line or staggered hole patterns may be punched with Wales Hole Punching Units.

● Setting up Wales Units is a simple assembly operation outside the stamping press or press brake. This fast, time-saving feature permits set-ups to be moved onto the press bed and start production with the first down stroke of the press ram.

With punch and die held in perfect alignment by a holder, this independent, self-contained design eliminates the usual time consuming, *individual* adjustments required to align conventional dies. Nothing is attached to the press ram.

Each Wales Unit is independently mounted which provides quick set-ups for various hole punching patterns. Such set-up flexibility keeps this tooling investment in practically continuous productive operation.

A GOOD RULE—Check with Wales-Strippit before punching or notching angles, channels, extrusions or sheets by any method.

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GEORGE F. WALES, *Chairman*
355 PAYNE AVE., NORTH TONAWANDA, N. Y.
(Between Buffalo and Niagara Falls)
WALES-STRIPPIT OF CANADA, LTD., HAMILTON, ONTARIO
Specialists in Punching and Notching Equipment

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The multiple savings in time and investment with Wales Equipment is too BIG a story to tell in this space, so write for fully-illustrated, functional-colored Catalog BL and Catalog N.

1876 1951

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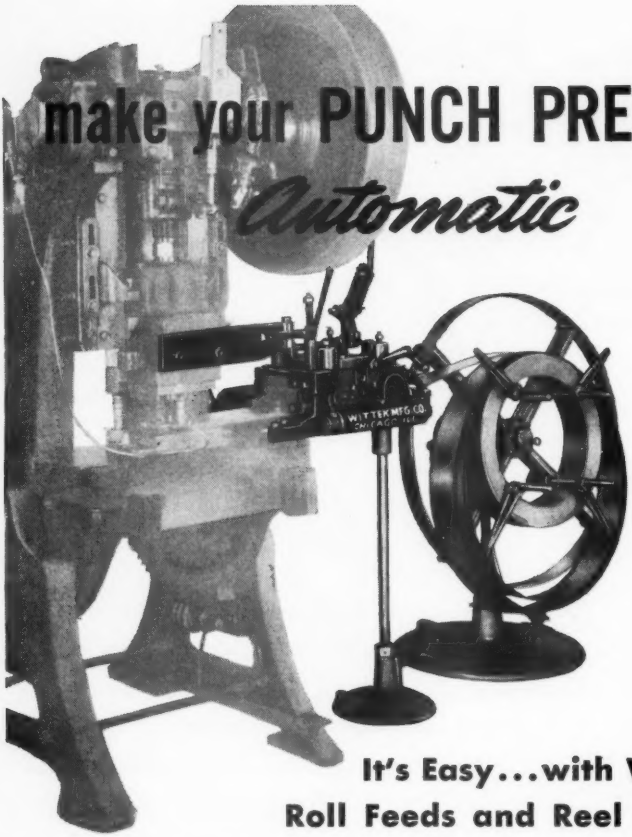
make your PUNCH PRESSES *Automatic*



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Wittek Roll Feeds handle any type of coiled strip stock and are made in single roll, double roll, and compound types with straighteners, in models to feed in any of four directions. They are reliable and accurate with simple, quick adjustment of feed length. Standard sizes and models meet a wide variety of press size and capacity conditions.

Wittek Reel Stands facilitate handling coiled stock.

Write for full particulars

WITTEK Manufacturing Co.

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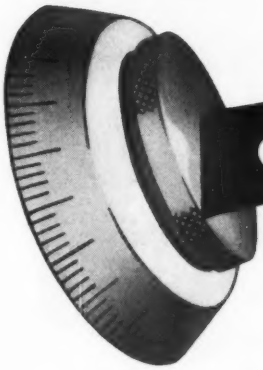
Automatic ROLL FEEDS AND REEL STANDS



GRADUATE DIALS . . .

this fast, easy way!

The **ABRASIVE MODEL GC GRADUATING MACHINE** puts new speed into your graduating operations. Dials, handwheels, knobs — in fact almost any circular parts requiring accurate, machine-cut graduations can now be completed in a fraction of the time taken by old-fashioned make-shift methods.

Here's a case in point: A Model GC Graduating Machine now completes the 250 graduations on a 5¼" handwheel in 1¾ mins. as against 45 mins. per piece by the method formerly used. Hourly output — 34 accurate, clearly graduated handwheels.

Graduating anywhere from 30 to 55 wheels, dials, etc., per hour is typical of this machine. It's highly adaptable, too. You can change from one size and type of work to another with a minimum of time and trouble.

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Abrasive Quality is Reflected in the Finish of Your Product

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ACCURACY BOOSTS PRODUCTION

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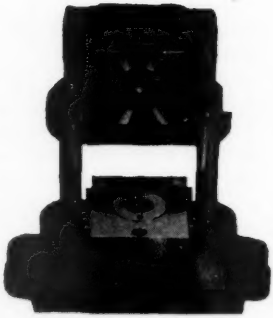
OFFERS YOU THIS SIMPLE, UP-TO-THE-MINUTE METHOD

There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



Made in 5 sizes:
¾"—1½"—2½"—4"—6".

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MEMO
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J.S.
"DETROIT" standard die sets are Micro-metric jig-bored and machined to exceptionally close limits of parallelism, flatness and squareness with the guide-pin axis. This precision reduces strain warping, and results in longer die life and long, uninterrupted production runs. Order from your "DETROIT" representative.
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You can't afford to make a mistake about such a basic requirement. It demands the *finest* of equipment. Therefore, be sure . . . specify PRATT & WHITNEY! Complete information on the full line of P&W Basic Measuring Equipment is available at your nearby P&W Branch Office.

These Bulletins describe P&W BASIC MEASURING EQUIPMENT. They can be obtained from any P&W Branch Office, or we'll mail them to you in response to a request on your letterhead.

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with the most uniform wheels ever produced!

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NORTON
ABRASIVES

Making better products to make other products better

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let America's foremost die-maker prove to you that good tooling pays off

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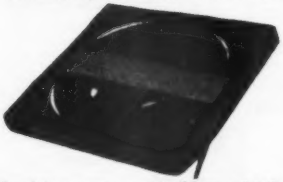

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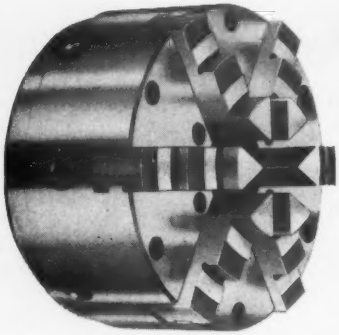

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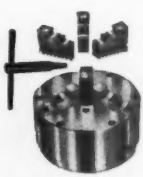

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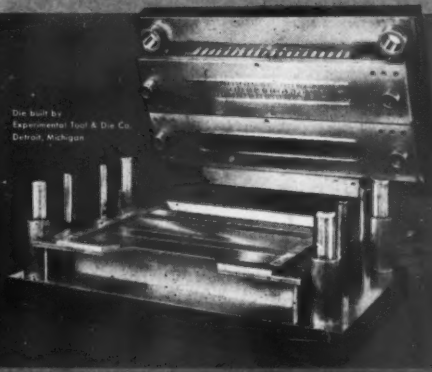

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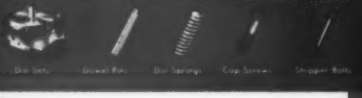

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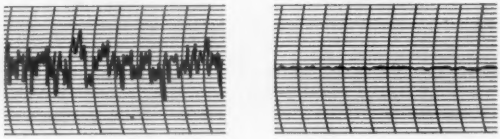

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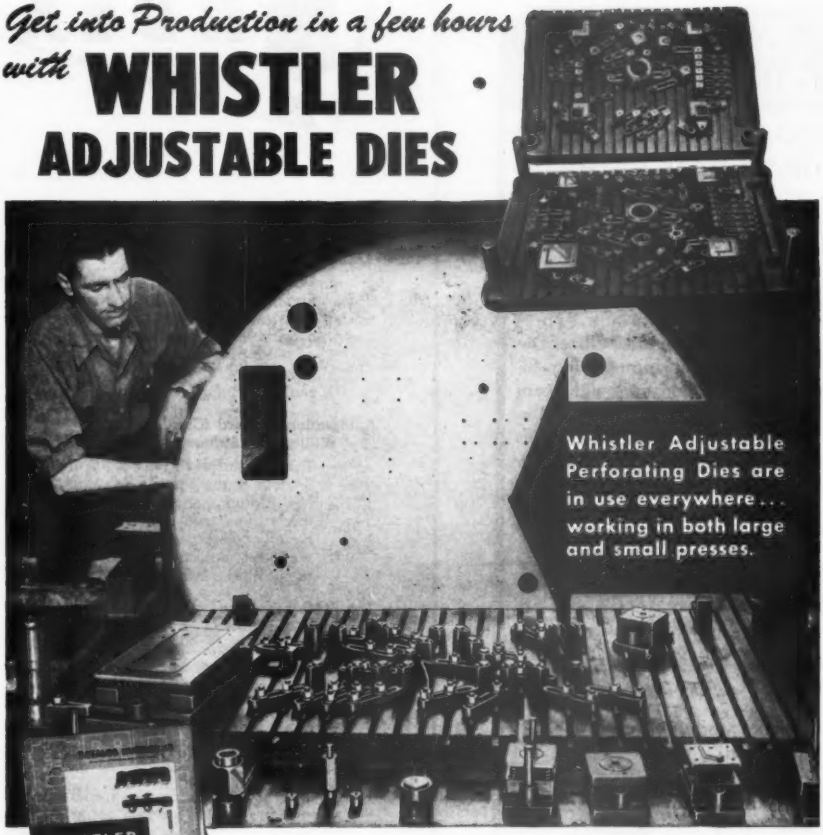

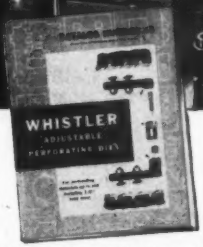

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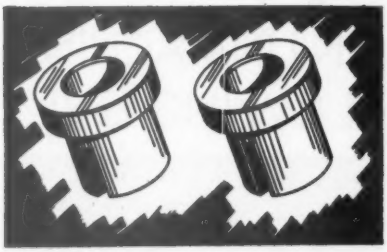

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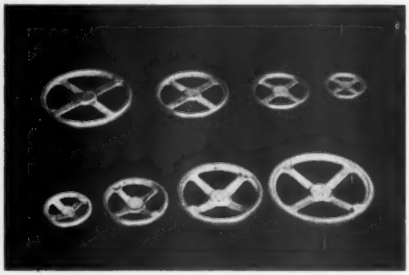

Just think of it — immediate delivery on every item in our cast aluminum line — shipped the same day your order is received, providing your order is for *unfinished* controls. Order now for the future and do your machining in your own or contract plant — no delays — no tie ups on your production line.

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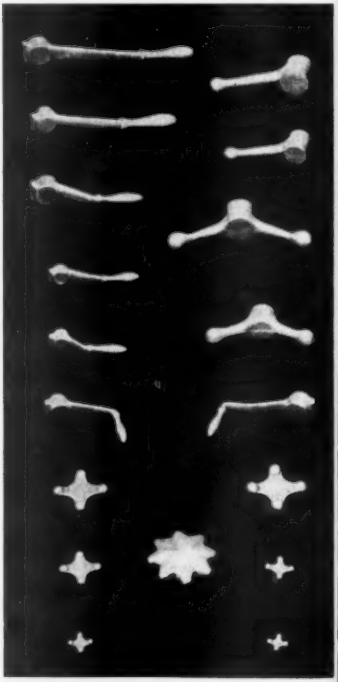

We are extremely fortunate that most of our items can be shipped the day the order is received—but unfortunately this is not true of our complete *standardized* line. The hand wheels as illustrated are available for immediate delivery in either straight or angled shapes in diameters of 6″-8″-10″-12″ unfinished. Hand knobs are immediately available in six sizes. Offset Handles in four sizes—crank handles in three sizes—speed handles in two sizes—clamping levers in two sizes—all these items were tumbled—are immediately available and require very little finishing on your part.

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It has been said, when speaking of our free enterprise system, that nothing happens in this country until somebody sells something. We who live and work in the world of TOOLING and PRODUCTION are obliged to point out that nobody sells anything until somebody makes something; be it textiles, trucks or trombones.

Now we are engaged in a war that is proving how great the defenses are which we must build against those enemies of our way of life; defenses made of air -, land - and water-craft, missiles, armament, instruments and supplies. Most of this, at the present writing, still needs making; making on a tremendous mass production scale.

The high production manufacturers of things to sell and the mass producers of ordnance items depend upon the TOOLING industry in order to get into PRODUCTION.

In reference to our military program orders being placed at the rate of 4 billion dollars a month, a top defense production official said, "Deliveries, to be sure, are not being made at anything like this rate because of the long lead time necessary to build complicated items in today's arsenal". To the uninitiated, "long lead time" is Washingtonese for the designing and building of TOOLING.

The difference between making one piece and 500,000 pieces is TOOLING. TOOLING is the multiplication table that gives PRODUCTION. TOOLING, and only TOOLING, makes possible the PRODUCTION of 500,000 pieces at a saleable price or within the time demanded by our armed forces.

Very few makers of TOOLING, be they individual concerns or toolmaking departments, can be classified as big business as compared to the users of TOOLING, i.e., the PRODUCTION manufacturing plants. Nevertheless, the builders of TOOLING are consumers of great amounts of material, procurers of precision toolmaking machines and equipment, and they are the employers of our finest engineering-craftsmen.

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We cannot have PRODUCTION without TOOLING. Given the TOOLING essential to the PRODUCTION job that needs doing for the balance of this year and next, our economists and strategists are in close agreement that we can look forward to having, in 1953, a real military security, a greatly expanded productive capacity which can be used for peace as well as for war, and a civilian economy producing goods at unprecedently high levels.

Our editorial pages are devoted to marking the path to this goal, via TOOLING and PRODUCTION.

E. Willard Pennington

Publisher

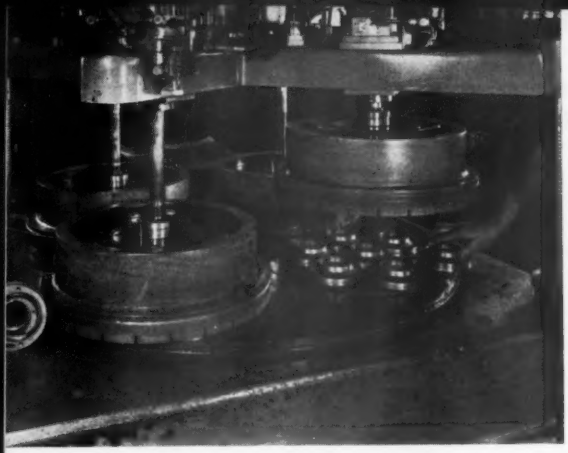


Fig. 1. View of 48" Crane "Lapmaster" showing three conditioning rings with work loaded inside. The fourth ring has been lifted from the table as for loading and unloading. The part being lapped is the Front Oil Pump Body.

Mass Production Lapping Techniques*

Lapping, broadly speaking, may be considered a process for refining the surface of a machine part by the use of abrasive, either loose or in the form of a bonded wheel, at surface cutting speeds very much lower than those commonly used for grinding.

Grinding is usually done at a cutting speed of 6000 feet per minute or higher, resulting in a visible spark and the generation of considerable amounts of heat. Lapping on the other hand is performed at one-tenth or less of this cutting speed, and with very low unit pressure. Heat generation is either negligible or can readily be removed by the coolant and of course no spark is ever visible. Also, lapping removes metal at a very much slower rate than by grinding allowing a somewhat better opportunity to control the accuracy of the part.

The high speed and consequent heat generation along with relatively high unit pressures from the grinding wheel result in considerable difficulty in controlling the accuracy of a machine part during a grinding operation particularly where flat surfaces are involved.

*This feature, originally a talk before the Society of Automotive Engineer's 1951 Annual Meeting, is presented through courtesy of the Society and the author, Mr. Moore.

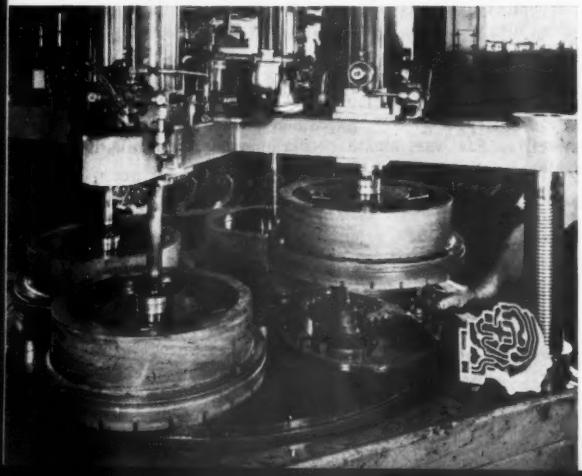


Fig. 3. The Transmission Valve Body shown at the right of above photograph requires a very flat surface to insure an oil tight seal between the intricate oil passages and is shown here as set up on the 48" machine.

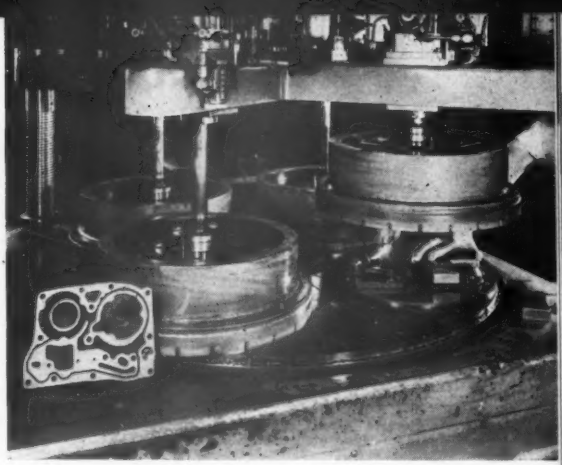


Fig. 2. The 48" "Lapmaster" as set up for Transmission Servo Cover. The steel plate shown provides additional weight as well as better distribution of pressure over the area being lapped to shorten the machine cycle.

by **Charles R. Moore**
Chevrolet-Cleveland Division
General Motors Corporation

Another problem common to all methods of finishing, except lapping, is caused by the need to chuck or hold the part securely while it is being finished. This chucking pressure bends or otherwise distorts the part prior to the operation, and even though the surface may be finished to a high degree of accuracy while in the chuck, upon release of the chucking pressure the part returns to its original form leaving the surface distorted.

The term "lapping" is very loosely used in industry. Traditionally, lapping referred to the process using loose abrasive, cast iron plate, and an infinite variation in abrasive path. The term "honing" on the other hand generally described the process where a bonded abrasive was used with a limited combination of abrasive motions. Later, "honing" by common usage referred to the process of finishing internal cylindrical diameters by expanding, under pressure, bonded abrasive stones radially against the internal surface while imparting both rotation and axial motion, as in automotive cylinder bore honing.

For the purposes of this paper all such related processes have been included, without regard to fine distinctions, as they are all precision finishing processes with the same common characteristics of low surface cutting speed without visible spark, low unit contact pressure, multiplicity of abrasive cutting paths, and absence of distortion due to chucking.

Surfaces finished by conventional mass production techniques such as milling,

Fig. 4. The face of the Transmission Case against which the Servo Cover (shown in Fig. 2) is bolted, must also be lapped. The machine being used is a 72" Crane "Lapmaster."

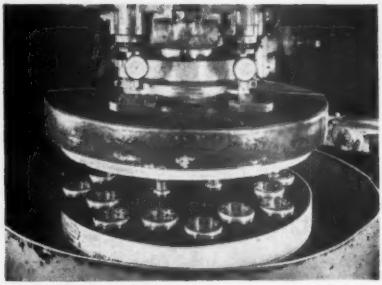


Fig. 5. Norton "Hyprolap" as set up for lapping opposite faces of Overrunning Cams. The two opposed wheels have been shown separated as in the loading position. The work holder is of the "simple type" described in the text.

precision turning or facing, and grinding have defects which sometimes influence the final operation of the mechanism to a serious extent. These defects can be divided into two classifications both of which can be corrected by some variation of the lapping process.

The first, surface roughness, is produced by the cutting tool used. Grinding produces a scratch pattern nearly always in one direction, the magnitude of which is a function of abrasive grain size in the wheel, bonding of the abrasive and method of truing. Milling and precision turning leave a tool mark the nature of which is determined by the rate of feed across the part and the shape of the cutting edge. This type of defect can usually be measured by the use of conventional surface roughness indicators such as "Profilometer", "Brush Analyzer", "Fax-Film", and is usually defined in terms of "Micro-inch."

The second type is the broad deviation from the basic surface which we are trying to produce. If a flat surface is desired the error would be the deviation of any part of the area from a theoretically perfect plane touching the part. This can be checked by such elementary methods as placing the part on an accurate surface plate and then checking for open spaces with a feeler gage. A better way is to set up the part on a surface plate with tool makers jacks with the surface exposed upwards in such a manner that some three points indicate zero with a height gage when indicated from the surface plate, then explore all other points on the surface for deviation from the plane so established. Still another way would be to coat the surface plate with toolmaker blue, pass the part over the plate, then examine the pattern of blue on the part.

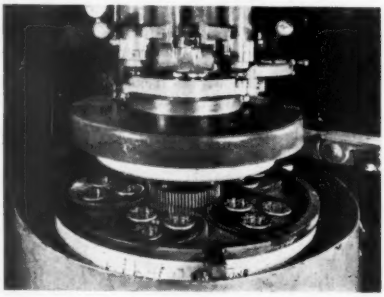
The most accurate method, however, is by the use of an optical flat and monochromatic light which, when placed upon the surface, will indicate by interference bands of light, the degree of flatness of the surface. This method is only practical for surfaces that are relatively accurate and will reflect light.

Deviation from a true cylinder or other geometric form would also be included here and are generally checked by the use of an accurately ground master and toolmakers blue.

Generally this second class of defect is caused by difficulties in the machine itself, or the fixture holding the part, such as spindle bearings, inaccurately machined or worn ways, lack of rigidity of machine frame and last, but probably most difficult to eliminate in mass production, distortion of the part during the finishing operation caused by fixture clamping pressure.

The operations described will primarily cover the lapping technique as applied to the mass production of the Chevrolet "Power-Glide" automatic transmission wherein the accuracy to be obtained by lapping is necessary for the following reasons:

Fig. 6. Norton "Hyprolap" equipped with a planetary type work holder. The part shown is the Overrunning Cam, same as in Fig. 5.



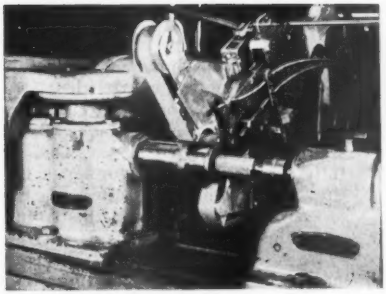


Fig. 7. Norton "Simplex Finishing Machine" as used to refine the surface finish on the Transmission Stator Race.

An automatic transmission operates at internal hydraulic oil pressures as high as 180 lbs. per sq. inch, and at temperatures which may go as high as 300° at which point the viscosity of the oil is between 3 and 4 seconds. Even though a gasket of special design is used on all mating surfaces, a high degree of flatness of all surfaces is necessary to prevent both internal leaks which may affect mechanical functioning of the unit and external leaks which result in loss of oil.

There are a number of parts, particularly cover plates for the two oil pumps that must be flat and parallel within very close limits to insure proper alignment when bolted together. The oil pump gears are also lapped to a tolerance of .0003" for thickness and .0001" for parallelism to insure axial operating clearance of .0005" to .0007" with a minimum of selective assembly.

Lapping also provides a perfectly flat locating surface for manufacturing purposes on precision boring operations on the valve body and oil pump body. If the locating surface were not flat, the part would distort under clamping pressure in the precision boring operation, then upon release, the bored holes would not be straight or to uniform depth.

In addition to lapping of flat surfaces, there are a number of cylindrical surfaces both external and internal upon which this refinement of surface is necessary to insure long life for the transmission as they act as bearing surfaces for babbit bushings, overrunning cam rollers and needle bearings.

The machinery used for production lapping on the Chevrolet automatic transmission parts are of the following three types, the principles and applications of which will be described separately:

1. "Lapmaster" manufactured by the Crane Packing Company is used to generate relatively large flat surfaces on cast iron parts.

2. "Hyprolap" manufactured by the Norton Company is used for flat surface work on the smaller parts as well as all of those requiring two parallel surfaces.

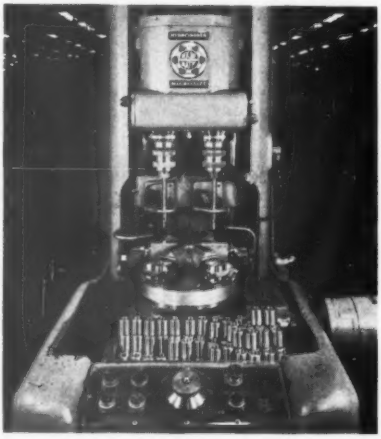
3. "Simplex" lapper, also a product of Norton Company is used to refine the surface of all external cylindrical parts where required by engineering specifications.

4. The Micromatic Hone Corporation 2-spindle "Hydrohone" accurately controls size of holes in planetary pinion gears both before and after hardening and also provides the necessary refinement of surface finish.

The guiding principles in the choice and application of this equipment were

(continued on page 62)

Fig. 8. Micromatic Hone Corp. "Hydrohoner" being used to precision finish the center holes of Transmission Long Pinion gear blanks, two at a time for a total of 245 net pieces per hour.



AUTOMATION AT FORD (continued)

MAINTENANCE

Always a subject of debate is maintenance of automation equipment and for that matter any equipment. As we have discussed the entire subject of automation we have seen how it has been a slow development actually beginning in the early days of the application of conveyors.

Conveyors at one time, were considered as a source of trouble and considerable down time resulted from failures. Proper design, heat treatment, selection of the right unit for a job, etc., gradually made them reliable.

The whole idea of maintenance has changed along with the need for continuous low cost production. There was a time when maintenance consisted largely of repairing equipment which had broken down. It was operated on a Fire Department basis. This approach is no longer satisfactory. Our entire production system is geared to so many pieces per hour with no possibility of making up lost production because of breakdowns.

by **William B. Slattery**
Manufacturing Engineering Staff
Ford Motor Company
Dearborn, Mich.

To cope with the modern production problem, preventive maintenance is the order of the day. Keep records of lubrications, expected life of details which go to make up a system. Replace parts before they become breakdown casualties, etc., are all part of the new outlook on maintenance.

These principles of maintenance apply to automation just as they do to any other piece of machinery. The automatic transfer machine tools are prefect examples of the maintenance problem. We have seen quite a number of installations of these recently with their built-in automation equipment and the question always comes up.

The last two to three years there have been many symposiums on the subject and it all simmers down to this:

To maintain transfer machines, men must be trained, controls must be designed ruggedly, wiring must be carefully done and labeled for quick identification and existing standards must be utilized. The earlier the training programs starts the better.

We have seen transfer machinery on engine programs as low as 10 units per hour and justified on the basis of cost data developed since their purchase.

Automation equipment is an extension of the machine tool automation in many cases. The same principles apply.

In other words, the age of completely automatic processes is approaching and portions of it are already with us.

Automatic machinery and equipment of all kinds are being bought every day on the basis of expected reduced production costs and experience already gained which have proved similar units.

To elaborate on this, we would like to bring out some of our experience and present state of development. We refer, again, to our example of an actual recent design job in a Cylinder Block department. As we discussed economics, we saw the value of careful analysis.

From the maintenance standpoint, some interesting developments occurred. The system developed was actually simpler than the standard equipment which had been used for years in similar departments. A careful attention to details made it possible to design a standard section for the different portions which could be duplicated in varying lengths. The machine tools were located with spaces between which were even mutiples of the standard section.

The resulting design had a minimum of parts and the interchangeability of these parts was decided upon to ease the maintenance job.

THE FUTURE OF AUTOMATION

For a true perspective in evaluating the future of automation we must consider it in its true relationship to other

AUTOMATION at Buffalo Stamping Plant

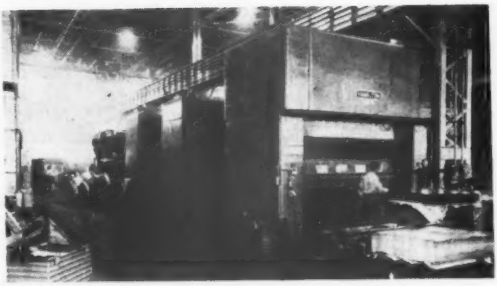


Fig. 1 showing rear floor pan line. This line of new, modern presses is the first to be in operation completely equipped with automation and other means of facilitating material handling. The dollies with their load of blanks are brought up to the press as a trailer behind a fork truck or other vehicle. They are raised and located on the south end of the raised track by fork truck or crane.

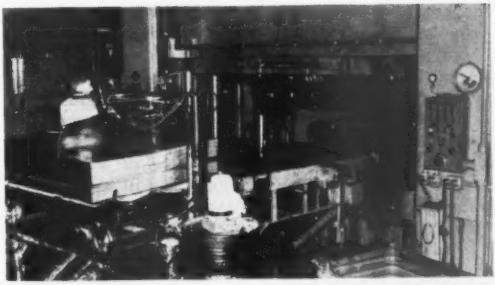


Fig. 2 showing close-up of dolly and loading device. The single operator peels each sheet off the top of the stack on the dolly as the press is closed making a draw. As the press opens, mechanical lifters raise the formed pan a few inches above the die. As soon as the air operated iron hand on the far side of the press clamps the pan, the air operated automation moves forward, pushing in a new blank and pulling out the formed part.

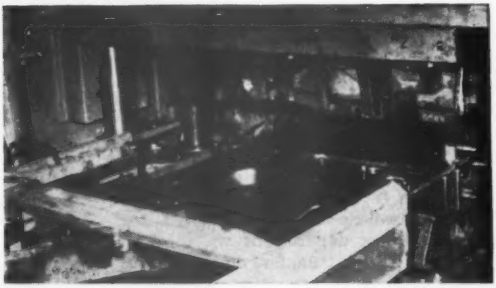


Fig. 3 showing close-up of rear pan extracted. The pan is dropped on the belt conveyor below by an iron hand as the bridge approaches the end of its outward stroke. The mechanism returns to the initial position as the operator starts the next cycle of the press by means of a foot switch, and the belt conveyor transports the pan to the trim press.

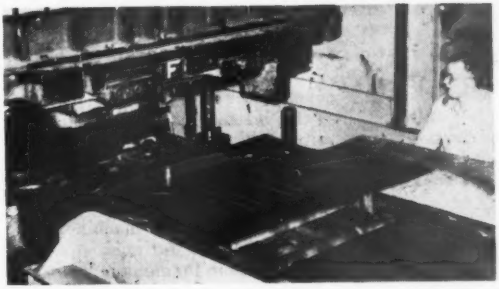


Fig. 4 showing trim press. As the trim press opens, lifters raise the part into position for the air operated iron hand, which grips the part. The two halves of the air operated automation are connected by tie bars straddling the die. As the mechanism moves forward, one part is extracted as the next part is pushed into the die without manual assistance.

programs. The cost of the program is only a portion of the machinery, equipment, and tooling which it ties into. A large amount of work has been done in improving tooling and machine tool designs which in itself is part of the overall program of industrial improvement.

Our automation program cannot be any better than the other production facilities which it becomes a part of. It is the missing link which assists these facilities in developing their maximum usefulness and at the same time produces substantial benefits itself.

At the Ford Motor Company, we feel that it is an important tool in the ever expanding field of Manufacturing Engineering. It is a "must" in the industrial picture of today and the future.

To get an insight into the actual technical development which is taking place and will continue to take place, let us review some of the accompanying pictures. Many of the earlier devices shown were built around machines which were manufactured at a time when automation was not considered. The automation designer had to use all of the ingenuity at his command to tie machines together to get a satisfactory system.

The other pictures show the improvement of a comparatively few years. We saw the two axle housing transfer machines which machined the complete part. Only a few years ago many single purpose machines and many manual transfers would have been required.

From these comparisons it should be easy to imagine the operation of the Cylinder Block department we referred to as one large transfer machine with no material handlers. Machine operators would be at essential operations only. Skilled mechanics would be available to maintain the entire system on a preventive maintenance basis. Machine tools and individual tools would be classified on the basis of expected life. Replacements on tools would be made before complete wear-down, perishable parts of the machines would be replaced in the same manner.

To accomplish this, we must remember that the automation engineer must take the responsibility of coordinating the activities of many groups to get the job done properly within the Manufacturing Engineering activity of the Company.

The Ford Motor Company is doing all it can to improve practice.

Our organization is a large one with many divisions all operating on a competitive basis. Many programs are going on at the same time, and we need all of the help available from the Machine Tool Industry in coordination of the programs under way now and in the future. Those of you who have had contact with operations at the Rouge can understand the complexity of the problem with all of the activities concentrated there and the further complication of expansion and decentralization.

We can safely say that to get the job done right much of the future lies in the hands of the Machine Tool Industry.

This can be done on the basis of a four point program as follows:

(1) Continue to develop machinery, taking into account the full significance of automation.

(2) Close cooperation with the Purchaser of machine tools.

(3) Coordination within the various groups of machine tool builders.

(4) Spread information on the subject to groups not now actively working on automation as a definit program. Encourage exchange of ideas between industries.

There are several industries in the country today which are completely automatic and many departments in other industries which are automatic throughout. The future will certainly find more. A trend has developed, the possibilities are clear. It is a matter of continued and increased management attention, engineering thought and coordination to keep the trend going and to extend it for the maximum benefit of all.

In conclusion, we would like to summarize the benefits to be gained by a good automation system:

(1) Reduction in handling labor costs.

(2) A better utilization of direct labor by eliminating the need for the operator, in many cases, to load machines, and reduction of operator fatigue.

(3) A reduction in damage to parts.

(4) Increased machinery speeds.

(continued on page 114)

AUTOMATION at Buffalo Stamping Plant

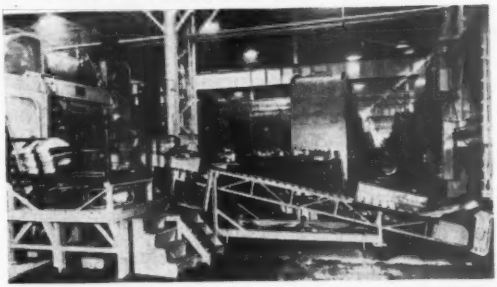
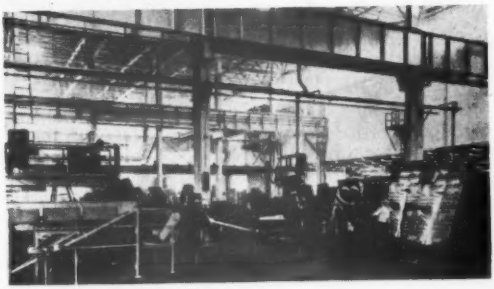


Fig. 5 showing flange press iron hand. A more conventional air operated and air lifted iron hand extracts the part from the flange press and drops it on a slat conveyor which carries the floor pan to the first station of the automation through the welders. As each welding cycle ends, the pans are moved forward one station through the welder automatically.

Fig. 6 showing front floor pan complete line. Adjacent to the rear floor pan line, (not shown), is the companion front floor pan line, a much larger part requiring two operators to handle the blank from dolly to feeder. The automation delivers the parts directly to the storage dolly loaders. This type of automation reduces direct labor, keeps presses operating at a higher rate and is much safer than manual handling.



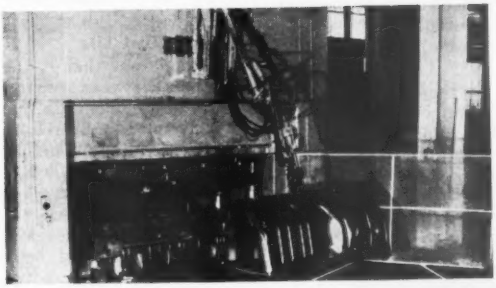
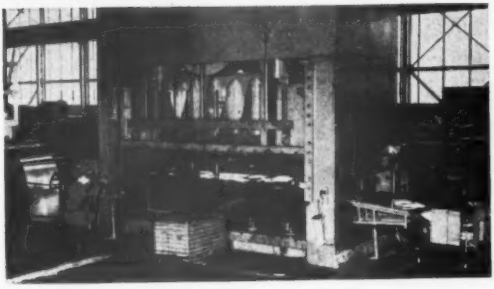


Fig. 7. This shows an interesting application of the iron hand on the front floor pan job. The iron hand removes the part from the press and at the backward position of the stroke a hydraulic cylinder acts to straighten the part out as shown and flips it over to land on the belt conveyor for delivery to the next operation.

Fig. 8. This is a completely automatic job which blanks steel for the wheel housings job. It takes a large coil, uncoils, passes it through rolls, through the press and to a waiting truck. Scrap drops into a skid box.



The Maintenance Grinding of Punches and Dies*

by

H. B. Elliott

Supervisor, Machine and Tool Shop Methods
Northern Electric Company, Limited
Montreal, Quebec, Canada

Inflation probably won't reach such a dizzy height but suppose pencils cost $475 each and the leads were just three-eighths of an inch long. You'd be mighty careful about sharpening a pencil, wouldn't you?

Silly question, you say? Yet careless tool grinding in industry today is sending thousands of dollars down the drain and shortening the operating life of costly high production tools which are vital in the defense effort.

In this article, Mr. Elliott presents methods of grinding cutting punches and dies to resharpen. These methods, applicable to all plants, have increased the operating life of cutting tools between grinds and have extended the ultimate life of these tools beyond previous expectancy.

The Northern Electric Company of Montreal is the supplier of telephone equipment to the Bell Telephone Company of Canada. In the manufacture of this equipment, some 7,000 punches and dies are on the shelves of the tool cribs in our various Product Shops.

Four thousand of these are cutting punches and dies and this paper presents the means we have developed to increase the operating life of these tools per grind and to increase their ultimate life beyond previous expectancy.

There is nothing mysterious in these methods and the same processes can be applied with profit in any production shop having adequate toolmaking equipment and modern concepts of tool quality and economics.

Study Group Set Up

The Company was faced with rising cost of manufacture and maintenance of tools and increasing schedules and in view of this, in 1949, a Tool and Machine Shop Methods Engineering group was set up. The original assignment was to study tool and machine shop processes with a view to reducing tooling costs. The work and outlook of this group has gradually broadened, and now, the usage of these tools and machines in production forms a major study.

Cost figures for 1948 and preceding years were available and from these, studies were made of the allocation of the toolroom dollar, which clearly showed that the greatest amount was being spent on the maintenance and repair of existing tools.

Needed Longer Tool Life

It was at once apparent that if the operating life of tools between repairs could be increased in any percentage this would be at once reflected in a decreased repair cost of like percentage. Further studies showed that in 1948, $35,000 had been extended in resharpening punches and dies and that $45,000 had been expended on replacements of punches and dies where the original tool had been expended in service by the gradual grinding away of the original die life of approximately three-eighths of an inch. These two items were chosen for Cost Reduction Study.

Considerable study has been made and literature published on the effect of surface finish on moving members such as gearing and journals and bearings, a lesser amount on single point tools such as lathe tools and milling machine cutters and none that we are aware of on cutting punches and dies, which have a shearing action.

*Contributed by the Production Engineering Division for presentation at the Semi-Annual Meeting (Toronto, June 11-14, 1951) of the American Society of Mechanical Engineers. Reproduced through courtesy of the Society.

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CINCINNATI MONOSET

Grinding the flutes at the end of a ball [illegible] die sinking cutter, on a CINCINNATI Monoset Cutter and Tool Grinder.

The taper shank cutters at the rear were made from scrap ground from the solid on a CINCINNATI Monoset. The other cutters and the two "chessmen" were also ground on a Monoset.

There's no need to tie up tool and die machines while waiting for a cutter replacement. You can make the cutter right in your own shop on a CINCINNATI Monoset Cutter and Tool Grinder.

Take a piece of suitable steel, or a larger broken or scrap cutter, grind it to shape, grind the flutes, and then sharpen in the conventional manner. One chucking does the whole job.

Small intricate cutters . . . the kind which you ordinarily order as special items . . . can readily be made in this manner. Because of its versatility in making cutters as well as in sharpening them, the CINCINNATI Monoset offers the possibility of quickly paying for itself. Write for literature, and find how these "nonproducers" will keep your production machines working.

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BROACHING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

The most compact reference I can give you is "How Smooth is Smooth?" by Ben C. Brosheer, associate editor of American Machinist. This is a study of published literature on surface finish and the instruments to measure the same and was published in the Sept. 9th and Sept. 23rd 1948 issues of American Machinist as a special American Machinist Report to the Metal Working Industries. It contains a bibliography of 113 articles and books on the subject over the period from 1930 to 1947.

Brochure Describes Tool Dulling

An analysis of the process of tool dulling is given in a brochure on "Milling Machine Cutter Grinding," a publication of the Cincinnati Milling Machine Company. The theory is that a roughly ground surface presents peaks to the work material. The pressure exerted on these peaks by the work material exceeds the shear strength of the tool metal and the peak crumbles or breaks away and the tool dulls in service, requiring resharpening.

This led us to the belief that if a perfectly plane surface were presented to the work material in a punch and die the blanking pressure would never exceed the shear strength of the tool material and were it not for foreign matter in the form of scale, slag and grit carried into the tool by the work material, the cutting punch and die would have infinite life.

We are today production grinding our cutting punches and dies to resharpen to a one micro inch finish with abrasive wheels, machines and coolants available to every plant, and have increased the operating life of these tools (without taking special means to control the same) in production by 2½ times. I will now tell you of the means we are using.

Several Grinders Used

Two Brown and Sharpe #5 Hydraulic Surface Grinders are used to grind the punches and two 10"x24" Norton Grinders are used to grind the dies. These machines are mounted front to front to permit one operator to run two machines, removing .0025" to .005" metal to resharpen and removing .00025" metal on the second machine to finish and yield a one micro inch finish.

The abrasive wheels are supplied by the Norton Company, their 32A46G12-VBEP and the finishing wheel their 32A90G12VBE. The 32A Alundum was chosen because of its ability to grind high speed steel and wear resistant high carbon-high chrome die steel without excessive wheel dulling, and the "G" hardness grade allows dull grits to be torn away in service presenting new cutting points. The 12 structure gives a very porous or open wheel.

This cutting combination has resulted in a wheel which will grind the toughest of die steels without burning or surface cracking the die material.

Ten-inch diameter by ¾" wide wheels are used on the punch grinders, while 20" diameter x 1" thick wheels are used to clear the guide pins on the die grinders. We have changed from a 1½" wide wheel with a resultant saving in wheel cost since it was found that this width or thickness was not needed.

Try Various Type Wheels

During development work we have used and discarded a 60 grit, vitrified bond roughing wheel and 180 grit vitrified bond and 320 grit resinoid bond finishing wheels. These did not cut as well nor produce as fine a finish as the wheels in service.

An operating practice we have discarded is that of taking the last thousandth of an inch off in passes of .0001". This amount of metal removal did not present work to the wheel and wheel bounce occurred and an orange peel finish resulted. In other words the wheel was peening the surface rather than grinding metal and the grinding time was extended to excessive lengths with no apparent increase in die life.

Hand honing of many precision dies has been stopped with a resultant saving, since the ground surface is superfinished.

For the proper functioning of many punches and dies, it is necessary to stagger the height of blanking, embossing and perforating the punches. For the guidance of the grinder operator a thin steel plate is pinned to the die. The required information is electrolytically

(continued on page 90)

New di-acro POWERSHEAR

Offers CONTINUOUS ACTION

plus

VARIABLE SPEED

from 30 to 200 strokes per minute

for *high speed*

DIE-LESS DUPLICATING

The new Di-Acro POWERSHEAR has remarkable speed and accuracy for the production of small parts and pieces. Consider these points:

1. **CONTINUOUS SHEARING ACTION**—no clutch to engage! Feeding speed determines shearing speed.
2. **VARIABLE SPEED**—cutting cycle quickly set for each shearing operation.
3. **EASE OF OPERATION**—with continuous operation fatigue is reduced, accuracy increases, production soars.
4. **"SINGLE STROKE" SHEARING**—non-repeating safety clutch for jobs not adaptable to continuous shearing.

Any plant doing high speed precision shearing on smaller parts cannot afford to be without the Di-Acro POWERSHEAR. Available in 12" and 24" shearing widths, capacity 16 gauge sheet steel. Also standard model.

DOES PRECISION WORK ON ALL SHEARABLE MATERIALS

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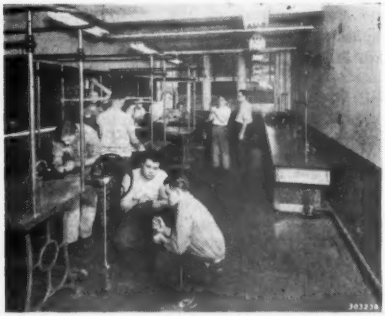
Apprentice Training at Westinghouse

The Apprentice System was in existence long before the discovery of America. Apprentice training in our country has been barely touched in comparison to the number of apprentices in training in many European countries. Apprentice training has never been fully accepted, nor has it received its proper recognition in the U.S.A. because, through fallacious thinking, white collar training has been considered more acceptable.

Fortunately, the management of our company has recognized the importance of a formal apprentice training program. We have had a recognized program since nineteen hundred (1900), and have graduated approximately three thousand (3000) journeymen from the fifteen different apprenticeship courses offered.

Modern apprentice training is not conducted in a haphazard manner, but is carried on with more care and attention to detail than may be found in many college curricula. Some educators have defined training as the process of developing through a series of progressive experiences the ability on the part of a trainee to do something he could not do before.



Applied mechanics is taught in this modern laboratory in the Westinghouse Apprentice School equipped with up-to-date training aids.

Tool, Die and Machine Design is one of the courses taught in the curricula of the tool and diemaker apprenticeship. Classes are limited to 15 apprentices so that instructors can give them individual attention.

However, it is not enough for a beginner's mind to be well stocked with carefully presented and well defined knowledge. His hands may possess the last refinement of skill but, unless there is created in him an ever-present urge to perform his daily tasks gladly, willingly, and pridefully, a most important part of his training has been neglected.

The development of morale must have prominence in any training program. Real morale, as distinguished from that obtained from misdirected and frequently overdone paternalism, must be developed in the trainee. The machine may emancipate the mind and the hand of the worker, but nothing can substitute for his heart.

We, at Westinghouse, believe that training is the process of developing through a series of progressive experiences the ability on the part of the learner to do willingly and pridefully something he could not do before. Three factors contribute to the successful development of ability.

First, a careful selection of the learner

(continued on page 64)

by **S. J. Dearbeck**
Supervisor, Trades Training Department
East Pittsburgh Works
Westinghouse Electric Corporation

PRECISION GROUND
OIL HARDENING NON-DEFORMING TOOL STEEL
Warplis
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... hallmark of fine quality oil hardening non-warping tool steel ... precision ground ready-for-use—smooth, parallel, accurate, free of decarb. Excellent—economical—for dies, tools and parts ... no appreciable warping after hardening. Stock sizes below; special sizes and lengths to order.

Squares

Stock Sizes, 18″ Lengths

1/8	5/32	3/16	7/32	1/4	5/16	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2	2 1/2	3

Flats

* Denotes Stock Sizes, 18″ Lengths

Thickness (Inches)	Width (Inches)												
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10
1/64			*		*	*	*	*		*				
1/32	*	*	*		*	*	*	*	*	*	*	*		
3/64	*		*		*	*	*	*		*	*	*		
1/16	*	*	*	*	*	*	*	*	*	*	*	*		
3/32	*	*	*		*	*	*	*	*	*	*	*		
1/8	*	*	*	*	*	*	*	*	*	*	*	*		
5/32	*	*	*		*	*	*	*	*	*				
3/16	*	*	*	*	*	*	*	*	*	*	*	*		
7/32			*		*	*	*	*		*				
1/4	*	*	*		*	*	*	*	*	*	*	*		
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3/8	*	*	*		*	*	*	*		*	*	*		
1/2		*	*		*	*		*		*	*	*		
5/8			*			*		*		*	*	*		
3/4			*			*		*		*	*	*		
1						*		*		*	*	*	*	*
1 1/4						*		*		*	*	*	*	*
1 1/2								*		*	*	*	*	*

Carbon .90 Manganese 1.10 Chromium .50 Tungsten .50 Vanadium .15

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Since 1902 ... makers of drill rods and other cold finished fine steels in all sizes, grades and shapes

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

. . . Lapping Techniques, from page 51

threefold. (1) The production capacity per machine had to be high enough to be in the mass production class. (2) Machine operation and maintenance had to be simple enough for an unskilled operator, and (3) finally, any fixture that might clamp or otherwise distort the part would not be tolerated.

"Lapmaster"

This machine is a relatively new development and its first application to mass production was made on the "Power-Glide" transmission. Figures 1, 2, 3, and 4 show typical applications of this type of machine. Loose abrasive suspended in a cutting fluid is fed automatically to a large horizontally rotating lapping plate. In contact with the lap plate are four "conditioning rings" which are restrained by suitable pivots or bearings from rotating about the axis of the lapping plate; however, they do rotate about their own axis as the lapping plate rotates due to the difference in speed and frictional force between the inner and outer diameters of the lapping plate upon which they ride.

The machine part to be lapped is loaded inside of each conditioning ring. A "work holder" cut from Bakelite or Micarta type of material fits inside the ring. The "work holder" has holes cut in it of a shape similar to the part to be lapped and spaced so that the parts do not hit each other. Thus, the conditioning ring along with "work holders" containing the parts rotate about their own axis at the same time that the lap plate covered with abrasive passes beneath it.

This "planetary" action causes the abrasive to trace an infinite variation of paths across the work continuously during the lapping cycle. When the part is removed from the machine there is no discernible pattern, and, if sufficiently fine abrasive is used, no scratch pattern will be apparent even under a magnifying glass. The latter would produce a surface of light band flatness and very fine microfinish.

The purpose of the "conditioning rings" is to keep the lap plate flat. They continuously wear the lap plate down at a slightly greater rate than the wear caused by contact with the work. They can be so positioned radially that the lap plate remains perfectly flat over very long periods—days and weeks. The practice is to check the plate once a day with a master straight edge.

There is never any tendency for localized out of flat along the radius, however, there may be a tendency for inner edge to be higher or lower than the outer edge. This condition may be readily corrected by moving the "conditioning ring" either in or out along the radius to correct. The lap plate in this Plant is not allowed to deviate from the master 48″ straight edge more than .002″, or .003″ on the 72″ machine.

Any part lapped on such a plate to the point where the original tool or grind marks are removed must then be as flat as the plate. Inasmuch as the parts being lapped are much smaller than the diameter of the plate the above 2 or 3 thousandths of an inch in 72″ does not affect their flatness appreciably.

For extremely accurate work using very fine lapping abrasive, the flatness of the plate and consequently that of the work can be controlled by the use of an optical flat.

The speed of lapping is a function of abrasive grain size and unit pressure of the work on the lap plate. For the purpose of present Chevrolet design where a gasket is used between external parts at assembly, 220 grain abrasive is used to obtain maximum cutting speed. A finish of 25 to 35 micro inch R.M.S. finish is obtained. The present high degree of flatness combined with this finish provides a satisfactory seal.

With the use of a finer abrasive there may be a possibility of eliminating all gaskets. Most parts of the transmissions do not have enough weight themselves to provide proper unit pressure for fast lapping so an additional weight is placed on top of the work. A felt pad is placed between the weight plate and the work to compensate for minor variations in overall height of the parts to distribute pressure evenly to all parts in the load.

The abrasive suspended in cutting fluid flows continuously from a power

(continued on page 66)

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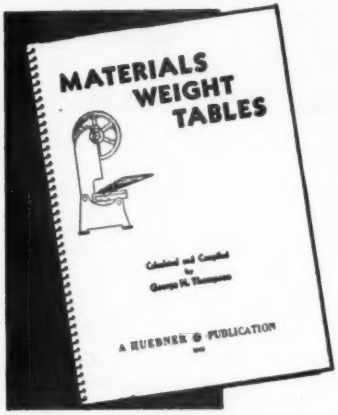

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. . . Apprentice Training, from page 60
with respect to physical, manual, mental, and moral qualifications must be made.

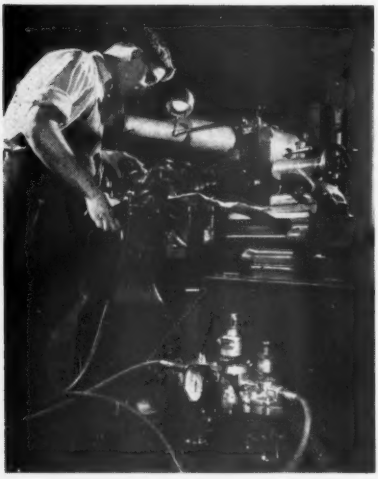
Second, a careful selection of the instructor is important because he must be a craftsman, a teacher, a psychologist, a leader, an advisor, and a friend.

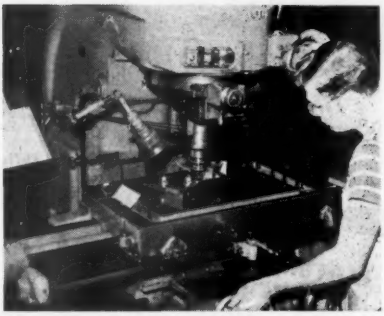
Third, a system of grading which is founded on facts and not on guesses must be developed. The system of evaluating the trainee's progress must be fair to both apprentice and employer in order that both may know whether actual results are being attained.

Few people realize that the American standard of living depends more on the skill of our mechanics than on any other single factor. The genius of our country is its production. With the demand for skilled help in the metal working industries becoming more acute daily, time is of paramount importance in alleviating this critical shortage. The selection of the right type of boy for training is very important. To assure a high quality of workmanship in its products, Westinghouse trains only the best. Quality must be built into a product; it cannot be inspected into it.

The basic purpose of any good apprentice selection program is to make more accurate predictions of success prior to actual training for the job. It must be based on sound selection procedure in order to make accurate forecasts of the probable success of the trainee in acquiring the necessary ability and skills to become a competent journeyman. These predictions must be based on factors other than I.Q. alone. Snap judgment has no more place in selecting a trainee than it has in applying fabricating processes and techniques.

An apprentice in Training Section is using an air grinding attachement to grind drill jig bushings on an engine lathe.





A toolmaker apprentice in Main Tool Room is shown machining a cavity in a mold on a die sinking machine.

A young man who is interested in learning a trade should have a sound basic knowledge of applied mathematics, and should be capable of reading and understanding what he reads in black print before he can hope to acquire the ability to read blueprints correctly.

The first step in the selection of apprentices is an interview. From a series of well directed questions by means of an interview form, we try to determine the boy's suitability for the desired trade. His appearance, attitude, aggressiveness, ambition, education, and environmental influences are all important factors in the proper selection. The applicant must be a graduate of an accredited high school or its equivalent, and have earned the following credits: 1½ units of algebra, 1 unit of plane geometry, 1 unit of chemistry, and 1 unit of physics. If the applicant fulfills all of these requirements, he is then assigned a time at a later date to take our battery of entrance tests. The battery

(continued on page 68)

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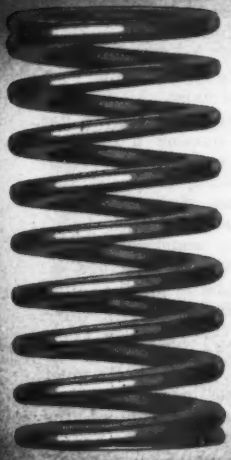

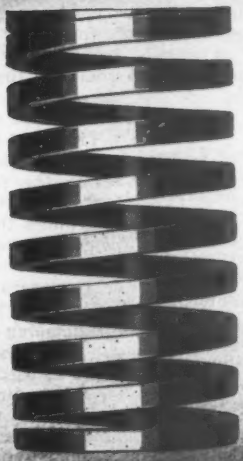

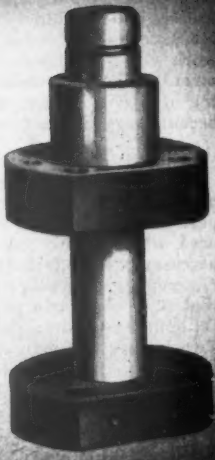

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. . . Lapping Techniques, from page 62

agitated tank through a metering orifice, along a wire track, to the outer surface of one "conditioning ring" from which it flows onto the lap plate. The spent compound carrying with it the metal particles from the work, lap plate, and rings as well as chips and dirt, flows off of the lap plate into radial grooves in the lap plate thence to the pump. The cutting fluid is salvaged but all other material is thrown away without reuse.

One disadvantage of this process common to all applications using loose abrasive and metallic lap plates is the black deposit of sludge remaining on the work at the conclusion of the cycle. This must be removed immediately by washing or it will harden on the surface and become very difficult to remove.

"Hyprolap"

This machine, Figures 5 and 6, has been available to industry for a long period of years and is quite generally used where highly refined surfaces are necessary. It differs radically from the "Lapmaster" previously described in that it employs two power driven vertical spindles fixed on the same centerline. Two bonded abrasive wheels are mounted, one on the top of the lower spindle, the other at the lower end of the upper spindle, so that their faces are opposed.

The "work holders" are fixed to an auxiliary spindle which provides rotary motion somewhat slower than the lap as well as an eccentric or crankpin motion, thus insuring that the work follows an ever changing path completely covering and slightly over-travelling the inside and outside diameters of the abrasive wheels. "Work holders," which are made of the bakelite type material, can be a simple disk the same in diameter as the wheels, with suitable holes to carry the work to be lapped, as in Figure 5, or they may be the more complex "planetary" type shown in Figure 6.

This latter design, arranges four or more holders of approximately 12 inch diameters with gear teeth cut on the outside, around a pinion drive gear fixed to the auxiliary drive spindle at the center. They also mesh with an internal gear slightly larger than the O.D. of the abrasive wheel. This arrangement provides a planetary motion similar to that described for the "Lapmaster."

The first or simple type of "work holder", however, does not rotate the part about its own axis so the scratch or abrasive pattern is always in one direction across the part. The "planetary" type of motion seems better suited to obtain the highest degree of flatness or parallelism between two surfaces. However, as this mechanism must be removed to dress the abrasive wheel, most production people object to its use.

The number of pieces that can be lapped per cycle or the main size is determined by the abrasive wheel sizes commercially available. At the present time this limit is 26" to 30", while on the cast iron lap plate type machine such a limitation does not exist.

Truing of the wheel to maintain a flat surface is done by passing a diamond across the face of both wheels simultaneously. As previously indicated, this determines the flatness of the part. The two diamonds are suspended on hydraulically actuated truing arms which pivot on very accurately aligned bearings.

This type of machine is ideally suited for finishing parts requiring two opposite and parallel surfaces. A 280 grain wheel is used resulting in a 20 or better micro film finish. The wheels must be dressed 4 to 5 times in a 8 hour day. This obviously is a function of the amount of stock removed and the degree of flatness desired.

By the use of bonded abrasive in place of loose abrasive and the elimination of the metallic lap plate, the work coming off this machine is relatively clean and bright, requiring very little washing.

"Simplex" Surface Finishing

In a third category are a number of parts having external cylindrical surfaces, the required finish of which is better than can be economically produced by simple grinding or precision turning. Here the parts are rotated relatively slowly on the spindle of the machine. Coated abrasive cloth or paper is clamped around and in contact with the work by suitably shaped shoes. At the same time

(continued on page 127)

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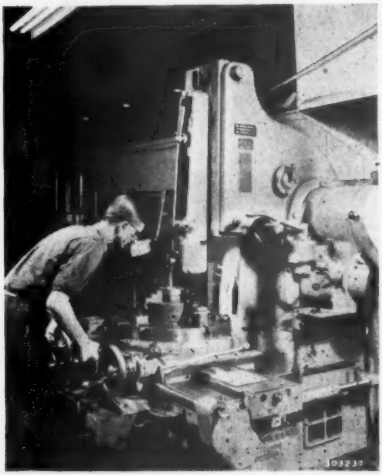
SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

. . . Apprentice Training, from page 64
of tests consists of an interest test, an achievement test, a mechanical comprehension test, two mechanical block tests, a personality and selection test, and a mental capacity test.

If the applicant passes our battery of tests, we then forward our own form to his high school for a transcript of his earned credits. This form also includes an objective rating scale of the boy's character traits and is evaluated by the boy's supervisor or counselor. He should have made a creditable showing in his high school work for the habits formed in high school to a high degree are carried over to industry. Our stringent



Here an apprentice is slotting a blanking die on a vertical shaper; one of the Training Section's required assignments.

requirements are such that we have often been referred to as the "West Point of Industry."

After a young man is accepted for our training program, he is assigned to our Training Section, or vestibule school.

The length of time a trainee stays in our Training Section depends upon his progress and the type of trade he is learning. The old practice of apprentices trying to learn a trade doing chore work or by trial and error methods has been

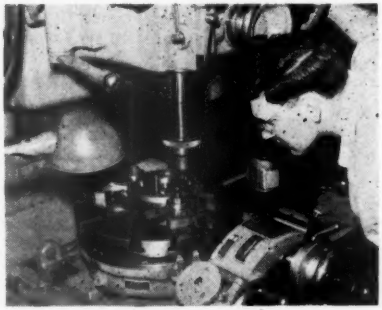
Carrying out another required assignment, this apprentice is facing a bracket on a horizontal boring mill.

eliminated years ago. From the first day a boy starts on his apprenticeship, he is trained on actual work that is a specific part of some piece or apparatus.

All training is performed on modern equipment and machine tools under the careful guidance of full time instructors who are experts in their trade and hold state certifications to teach the craft. After completion of each assignment, the trainee is given a series of tests to check the trainee's ability to perform the various operations of the assignment as well as his knowledge of the safety factors involved. If the trainee successfully passes these rigid examinations, he progresses to another assignment. If the trainee fails to meet the standards re-

(continued on page 154)

Boring a jig plate on a jig boring machine, as performed by this trainee, is still another required assignment.



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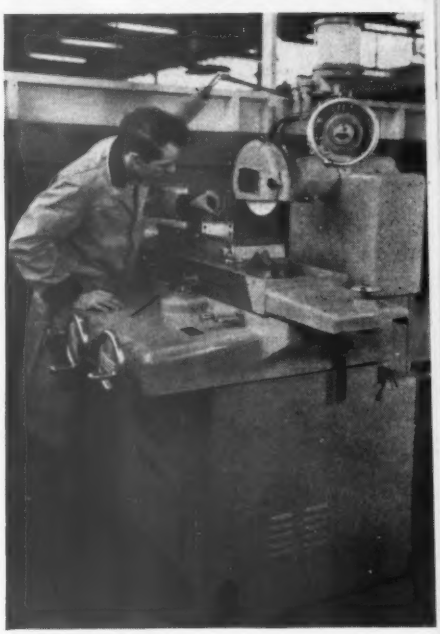

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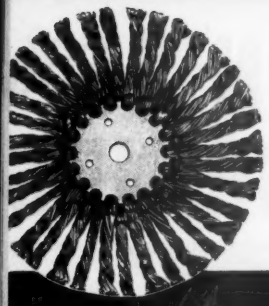

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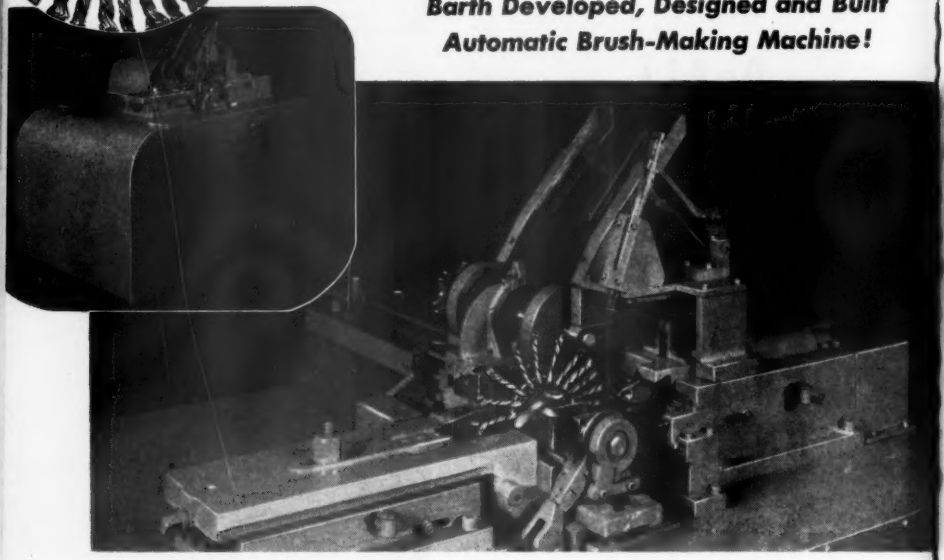

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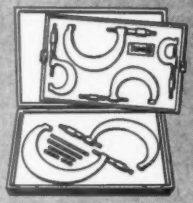

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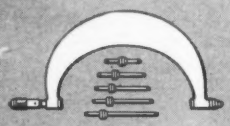

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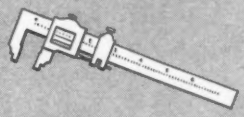

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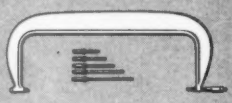

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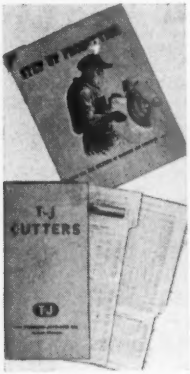

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Circle No. E14.

PRESSES

Hannifin's current Bulletin 130A offers 20 pages of hydraulic press information. Dimensions, specifications and engineering data are given.
Circle No. E15.

GRINDERS

Forty-four pages of catalog material on grinders, polishers, buffers and speed lathes make up The Standard Electrical Tool Company's illustrated Catalog No. 44.
Circle No. E16.

CHUCKS

You give multiple spindle range to single spindle drill presses when using Scully-Jones Quick Change Chucks and Collets. Bulletin No. 3-50 has full particulars and pictures.
Circle No. E17.

VISUAL-GRIND

New possibilities afforded by contour grinding with continuous inspection are outlined in this informative folder from The Cleveland Grinding Machine Co.
Circle No. E18.

PRESSES

Single and double action presses for rubber pad forming of aircraft parts are pictured in Bliss Bulletin No. 39. Schematic drawings are included.
Circle No. E21.

TUBING STEELS

Condensed technical data on 14 of the more popular B & W Tubing Steels are contained in Bulletin 12F. It gives facts on analyses, properties, creep strength, tensile strength.
Circle No. E22.

GRINDING

T&P readers are invited to submit their names for the mailing list of Norton Company's very informative external house organ, "Grits and Grinds." Published monthly.
Circle No. E23.

MEASURING

Tubular Micrometer's latest catalog is made up of nearly 100 pages of descriptions, photos and prices of precision measuring tools of all types.
Circle No. E24.

BEARINGS

A colorful four-pager from Bronze Bearings, Inc., covers flanged type bearings, Babbitt lined bearings, graphited oil-less bronze bearings, bronze castings, etc.
Circle No. E19.

DIE STEEL

"Prestem, The Hot Working Die Steel for Forging Presses and Upsetters" is a four-page Heppenstall bulletin describing the outstanding characteristics of this new alloy steel.
Circle No. E20.

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Cutting Tool Room Costs

V10 BOND WHEELS. With these wheels, you are assured of accurate low-cost grinding of tool steels—even Hi-Vanadium. White in color, they have unusual form and size holding qualities. And so versatile, wheel inventory is greatly simplified.
A PRODUCT BY CARBORUNDUM
V20 BOND WHEELS. Need fast and accurate repetitive grinds? Here's the RIGHT wheel. Blue-gray in color, they're noted for a high rate of stock removal at reduced wheel pressures, minimum heat generation. Producing higher finishes, they extend tool life between grinds, thereby extending over-all tool life.
A PRODUCT BY CARBORUNDUM

Only **CARBO** TRADE

"Carborundum", "Aloxite" and "Green-Grit" are trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, New York

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easy with RIGHT Abrasive

A PRODUCT OF CARBORUNDUM
"GREEN-GRIT" WHEELS
Carbide grinding calls for a cool-cutting wheel. CARBORUNDUM suggests the "Green-Grit" wheel, with superior form-holding qualities for lowest cost, accuracy and finish. Try it for the best carbide grinding results. Available in a complete range of grades.

No matter what your abrasive job in the tool room, there's a product by CARBORUNDUM to do it best. You select the *right* product for every job in the tool room from CARBORUNDUM's *complete line* of abrasives.

Your CARBORUNDUM representative or distributor is equipped to recommend not just a product, but a method. From his knowledge of *all* abrasives, he can help you select the very best abrasive method, and *then* recommend the abrasive product to be used. In this way, you *know* you're getting the best results at lowest cost.

● Don't forget the rest of the complete CARBORUNDUM line—Diamond Wheels, for instance, or tool room sticks, and complete selection of all coated abrasive products.

Brand New

A tool grinding booklet sent *free*. Detailed information, charts, illustrations.

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SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Thread Inserts and Metal Stitching Solve Assembly Problems

Helical Inserts Strengthen Threads in Aluminum Castings

Because helical-wire thread inserts substantially increase the loading strenghs of threads in light metals, and thereby lessen stripping possibilities, the Staplex Company of Brooklyn, N. Y., has specified them as original manufacturing components to solve a problem of stripped threads in its stapling machines.

Four rubber suction-cup legs screwed into the bases of these lightweight cast-

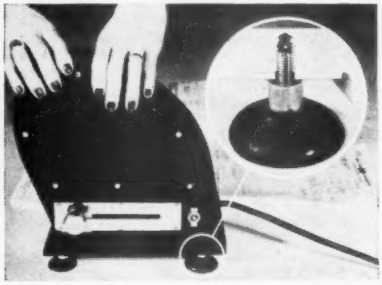


Photo courtesy Heli-Coil Corp.

Users of the Staplex automatic stapling machine sometimes use a rocking action to break the vacuum between the suction-cup legs and the mounting surface. On the prototype model, this action pulled out the tapped mounted threads in the machine's lightweight aluminum housing. Heli-Coil thread inserts now strengthen these threads and prevent stripping. Cut-away view shows how these precision-formed thread coils provide durable stainless steel liners between the tapped receiving threads and the threads on the suction-cup legs.

ings permit the machines to cling firmly to any flat surface and allow easy relocation of the machines when this is desirable. On the prototype model, the four 6-32 mounting threads in the casting stripped when the machine was rocked to break the vacuum.

To prevent the stripping of these threads on production models, 6-32 stainless steel Heli-Coil thread inserts are now being installed in these holes. Installation is as follows: four holes are drilled with .140" diameter drills; threads to accommodate the inserts are tapped with 6-32 Heli-Coil taps; and 6-32 Heli-Coil thread inserts are installed with inserting tools.

Threads in the insert-lined holes can safely withstand 20 to 30 per cent higher loads than unprotected tapped holes because of better load distribution. The spring-like coils of these inserts automatically adjust themselves to both the receiving threads in the castings and the threads on mated parts.

Instead of the conventional 50 to 60 per cent thread flank engagement between threaded members and receiving threads, helical-wire thread inserts provide flank engagements of about 80 per cent.

In addition to the resultant higher loading strength, the physical properties of the 18-8 steel used in the manufacture of these thread inserts are such that wear from repeated assembly and disassembly is practically negligible. Also, all possibility of corrosion, galling and seizure is eliminated.

Metal Stitching Speeds Rubber-to-Aluminum Assembly

Rubber feet are attached to aluminum ladder legs on Acme-Morrison metal stitching machines in 85 per cent less time than required for conventional drilling and bolting methods at the Burbank, California, plant of Bardwell & McAllister, Inc.

Metal stitches of .051" diameter steel wire are driven through three layers of material: rubber, aluminum and rubber. Total stitch penetration is ¼" of rubber and .093" of extruded aluminum channel. Wire costs are less than 1½¢ per hundred stitches.

Stitch formation is as follows: high-tensile-strength wire is automatically fed from a coil, cut to length, formed into a stitch, driven through, and clinched in 1/5 of a second. The cold-drawn 290,000 psi wire used has a corrosion-resistant zinc coating. In addition, it is manufactured to AN-W-13 specifications, can withstand 180° bends, is resistant to fatigue stresses, and can safely endure a 300-hour salt-spray test without detrimental corrosion.

Assembly for the former drilling and

(continued on page 89)

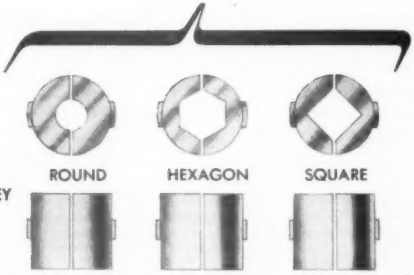
HARDINGE
ELMIRA, N.Y.

Style "B"

Master Feed Fingers and Pads

Get better performance and savings with Hardinge Master Feed Fingers and low cost replaceable Pads . . . interchangeable among different makes of automatics with the same capacity . . . available for all sizes of the following machines up to and including 3½" capacity:

BROWN & SHARPE
CLEVELAND
CONE
DAVENPORT
GREENLEE
GRIDLEY AND ACME-GRIDLEY
NATIONAL ACME
NEW BRITAIN



Each pad also furnished in Hardened Steel, Nickel Cast Iron, or Bronze to suit all materials and classes of screw machine work.

HARDINGE
ELMIRA, N.Y.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Machining and Fabricating of Fiberglas-Reinforced Laminates*

New applications are being developed today for Fiberglas-reinforced laminates at an unprecedented rate. Where there was only talk a year or two ago there now is real and gratifying action, with the promise of much more to come.

One important obstacle to the expanded use of these materials has been the lack of information on machining characteristics. Industry has been "gun shy" on applications requiring any form of fabrication. Because glass is known to be hard and abrasive, it was assumed

by **Roger B. White**
President
Laminated Plastics, Inc.
Cleveland, Ohio

that glass laminates were impractical to machine. It is true that some glass laminates, like the war-popular glass-cloth-melamine do require rather specialized machining techniques, but glass mat base polyesters should not be placed in this category. Experience has shown these materials to be roughly comparable with cotton canvas base phenolics in machining characteristics.

It will be the purpose of this paper to show that fabrication of polyester Fiberglas laminates by conventional techniques, with standard equipment, is far from impractical; and on the contrary, many high production items where unreliable or excessively costly operations could not be tolerated, are today being

(continued on page 86)

*A paper presented in Chicago before the Sixth Annual Technical Session and Exhibit of the Reinforced Plastics Division of the Society of the Plastics Industry. Courtesy of the Society and the author.

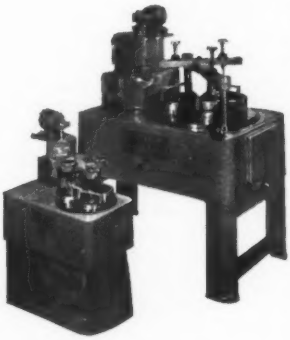
Part:	Washing Machine Balance Ring
for:	Apex Montgomery Ward Automatic Washer
by:	Apex Electric Co.
size:	3/32 thick x 2" x 12"
grooves:	Two ½" wide x 1/32" deep.
Operation:	Milling
Rate:	23"/m feed, 170 ft./min. cutter speed, 150 pcs./hr.
lot:	5,000
to date:	200,000
Machine:	Cincinnati #2 Milling Machine
Tool:	High speed steel cutters
Life:	2,500 pcs./sharpen—400 lineal ft.
Accuracy:	Thickness held to .005" tolerance
Lubrication:	Dry (Vacuum dust removal)

Table I—Approximate Tool Sharpening Schedules

	Milling-routing-turning Lineal ft. of work per sharpen			Blanking Pieces per sharpen
	High-speed cutter	Carbide cutter	Diamond cutter	High carbon chrome nickel dies
Vulcanized fiber	5,000 to 10,000	15,000 to 30,000	——	25M — 250M
Phenolic laminate	1,000 to 5,000	6,000 to 10,000	——	15M — 150M
Glass mat polyester	300 to 500	3,000 to 6,000	30,000 to 40,000	10M — 100M
Glass cloth melamine	——	50 to 200	10,000 to 15,000	3M — 50M

. . . Are You LAPPING PARTS Like These By HAND?

THEN YOU'LL WANT TO INVESTIGATE THE *NEW* LAPPING METHOD OF THE "JOHN CRANE" Lapmaster®



LAPMASTER "12" with 12" lap plate

LAPMASTER "24" with 24" lap plate

Every part shown in the above illustration could be lapped on the "John Crane" Lapmaster *in a single lapping cycle*—even though they are of different shapes and heights, and are made of such varied materials as hard and soft metals, plastics, ceramics and quartz!

The Lapmaster represents an entirely new principle of lapping, with such features as a self-conditioning lap plate and automatic lapping cycles. You can do more accurate work on this machine (to .0000116"), and you can do it faster—*even with unskilled workers.*

Lapmaster Models are not expensive. They are paying for themselves in machine shops, manufacturing establishments, automotive and aircraft plants and in research departments. To be up to date, you'll want the latest catalog on this precision machine. Write:

Crane Packing Co., Dept. TP-7, 1800 Cuyler Ave., Chicago, Ill.

CRANE PACKING COMPANY
LAPMASTER DIVISION • CHICAGO 13, ILL.
Offices in All Principal Cities in United States and Canada

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

MILITARY AND INDUSTRIAL PRODUCTION NEWS

Minimum Essential Goals for machine tool and related equipment production for the defense effort have been specified by the government, and methods whereby producers of these items can get the materials to make them have been provided. This latest action grants to these producers a priority rating DO-75 to assure sufficient production during the third quarter for the manufacture of component parts necessary for a balanced production of defense, defense-supporting and essential civilian goods. New Order M-60 specifies a rate of production of such essential component parts as nuts, bolts, gears and valves, and provides a priority rating to producers to obtain materials they need. NPA has further amended its construction order to assure that supplies will be available for building activities in defense and defense-supporting fields.

Everett M. Hicks, manager, Norton Company's Grinding Machine Division, has been appointed a member of the Industry Advisory Committee of the Office of Price Stabilization. Announcement of the appointment was made recently by Michael V. DiSalle, OPS director. This committee, composed of 16 members, will advise the OPS on price regulations affecting the machine tool industry.

Small Business Aid. Carrying forward the Department of Defense policy of helping small business and of expanding the production base, the Munitions Board has approved a new plan to make more procurement information available to business firms. The plan calls for publicizing every procurement of $10,000 and over; except where security does not permit. These listings will be given to the major procurement offices and will be condensed for publication in U. S. Department of Commerce synopsis forms. Procurement proposals listed will contain a condensed general description based as much as possible upon commonly used names for the supply items, and will state the basic fabrication materials and general size. Also included will be construction items such as the building of structures, roads, etc.

Two Ex-Cell-O Officers have been appointed to vice presidencies, according to an announcement by H. Glenn Bixby, president of the Detroit firm. Donald H. McIver is now Vice President in Charge of Industrial Sales, while George D. Scott becomes Vice President in Charge of Pur-Pak Sales.

Representatives of 22 U. S. Industrial Firms will acquire specialized training in nuclear engineering at the Oak Ridge (Tenn.) School of Reactor Technology during the 1951-52 term beginning in September. Of a total of 75 students who will attend the 12-month term, 24 candidates are sponsored by the industrial firms and eight by government agencies. The remaining 43 are recent college graduates who were selected primarily on the basis of their potential contribution to reactor development phases of the national atomic energy program.

Boyar-Schultz Corporation, 2110 Walnut St., Chicago 12, Ill., has opened a New York City Sales and Service Office at 401 Broadway. The new office is under the management of Oliver J. Green and under the supervision of Ed. M. Baumruck, eastern sales manager. A complete line of Boyar-Schultz Screw Machine Tools, Copper Head Laps and SMB Machine Bolts will be carried in stock for the convenience of Metropolitan New York users. Boyar-Schultz Profile and Surface Grinders may also be sold and serviced from this office.

"Mobilization Guide for Small Business" is a 31-page guidebook issued by the Defense Production Administration to help small business during the defense mobilization period. The booklet is a quick help in locating government services in defense procurement and methods of obtaining materials to supply consumer requirements. This guidebook can be obtained at all field offices of the Department of Commerce.

Herman A. Bottenhorn has been appointed Chief Engineer of Loewy Rolling Mill Division, Hydropress, Inc., New York. Mr. Bottenhorn is a graduate Mechanical Engineer and specialist in the design, development and manufacture of rolling mills for the ferrous and non-ferrous industries and has been a collaborator of Erwin Loewy, president of Loewy-Hydropress for over 30 years.

The Hardinge Company, Incorporated, New York, owners of Hardinge Manufacturing Company, York, Pa., have entered into a contract with the Meehanite Metal Corporation, New Rochelle, N. Y., to produce Meehanite castings in their foundry at York, Pa.

The Tool Steel Industry currently is saving scarce tungsten at the rate of 360,000 pounds per month through voluntary efforts.

CENTRAL READ-RITE

(PATENT PENDING)

ONLY $18.50 WITH RATCHET STOP AND LOCK NUT

The Central READ-RITE Micrometer *practically reads itself!* Numbers which automatically appear on the thimble, as you adjust the micrometer, eliminate the computations usually required in taking a micrometer reading. You read the true, *Certified Accuracy* measurement at a glance. This means faster, easier measuring — and eliminates costly mistakes in taking micrometer readings.

The *Read-Rite* is available in two polished frame models, 0 to 1" (illustrated) and 1" to 2", and six black enameled frame models with a combined range of 0 to 6".

SEND COUPON TODAY

CENTRAL *Certified Accuracy* MICROMETERS

SPECIALISTS IN FINE MICROMETERS FOR OVER FIFTY YEARS

Gentlemen:
Please send me the following:

☐ Read-Rite RR110RL 0 to 1" as shown. $18.50
Send check, money order or C.O.D.

☐ Descriptive Catalog 30 listing Read-Rite and other Central Micrometers.

Name.....

Address.....

City..... State.....

THE CENTRAL TOOL COMPANY
CRANSTON 10, R. I.

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

DIE-CO Guide Posts and Bushings for *Better* Die Performance

DIE-CO

Guide Posts

Shoulder

Commercial

Precision

Sizes: ½"x3½" to 3"x20"

★

DIE-CO

Bushings

Shoulder (Steel or Ampco-18 Bronze)

Extra Long

Short Straight

Heavy Wall Shoulder

Complete Supply in stock!

Greatest range of sizes now on hand for immediate delivery to you. They're all genuine DIE-CO—pack hardened and finish-ground to closest tolerances. Precision Pins honed to high micro-finish for maximum efficiency and long life. Famous for making your dies operate smoother, longer with less downtime. Order now for prompt service.

The DIE SUPPLY Co.

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DIE-CO

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All Metal JIFFY CABINETS

...Still Available

SIZE: 6"x25⅛"x15¼"

64 Drawer Unit... Only $24.95

1001 TIME-SAVING USES

SMALL PARTS	DRILLS
WASHERS	TOOLS
NAILS	TAPS
SCREWS	CARBIDE TIPS
BOLTS	MOUNTED POINTS
NUTS	LABELS

and YOU NAME IT!

All metal JIFFY cabinets have a sturdy steel frame with hammered aluminum finish in silver gray color.

Drawers are solid aluminum. Individual metal drawer guides keep the drawers in a free sliding position.

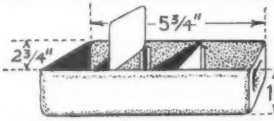
Full requirements of removable drawer-dividers and colored index tabs are furnished with each unit.

Units are packaged in individual cartons.

EXCELLENT FOR HOBBY SHOPS

ALSO AVAILABLE IN THE FOLLOWING SIZES and PRICES:

32 DRAWER	16 DRAWER	8 DRAWER
$12.95	$7.95	$4.95



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PLEASE SEND IMMEDIATELY THE QUANTITY AND SIZE JIFFY UNIT LISTED BELOW

64 @ $24.95	32 @ $12.95	16 @ $7.95	8 @ $4.95

PLEASE SHIP AS FOLLOWS:

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Ohio Customers Add 3% Sales Tax —U. S. A. Only

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Conserving Stainless Steels

Because nickel and other alloys are in short supply, more and more emphasis is being placed on light-walled Schedule 5 stainless steel pipe. This new pipe, produced by several mills, recently received the approval of the American Standards Association.

When compared with heavier pipe, such as the well-known Schedule 40, this new pipe schedule provides two or three times the pipe footage per pound of stainless steel. Thus, in addition to conserving critical alloys, Schedule 5 stainless pipe gives outstanding savings in cost for material. This pipe offers full corrosion resistance in every respect.

From the strength standpoint, Schedule 5 pipe is satisfactory for most industrial applications. It will provide an excellent margin of safety with working pressures up to 150 psi. Table I shows internal and external pressure data from various sizes of Schedule 5 stainless pipe.

Comparison of the wall thickness of Schedule 5 with Schedules 40 or 10 pipe (Table II) shows that the new schedule

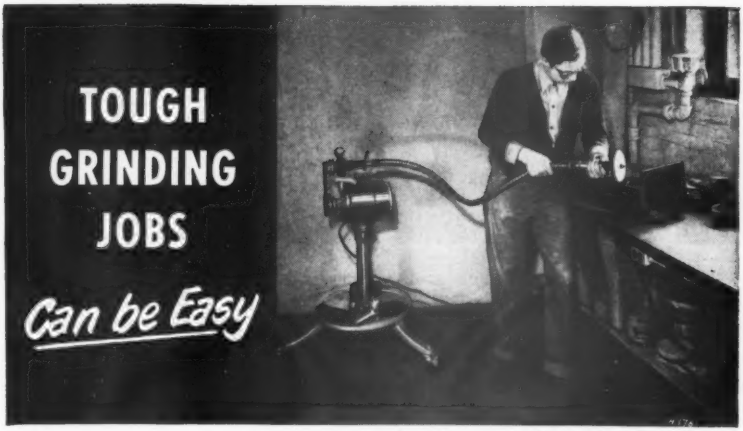
(continued on page 89)

TABLE I. PRESSURE TEST RESULTS FOR STAINLESS PIPE IN SCHEDULES 5, 10 AND 40

Nominal Size	Schedule Number	INTERNAL PRESSURE, PSI		EXTERNAL PRESSURE, PSI	
		Test	Bursting	Collapsing	External Working Pressure
¾"	5	1855	9280	3320	665
	10	2000	11850	4525	905
	40	2000	16130	6530	1305
1"	5	1485	7420	2445	490
	10	2000	12415	4795	960
	40	2000	15170	6075	1215
2"	5	820	4105	900	180
	10	1375	6885	2195	440
	40	1945	9720	3525	705
3"	5	710	3555	640	130
	10	1030	5140	1385	275
	40	1850	9260	3305	660
4"	5	555	2765	315	65
	10	900	4000	845	170
	40	1580	7900	2675	535

TABLE II. WALL THICKNESS, INTERNAL AREA AND WEIGHT PER LINEAL FOOT—SCHEDULES 5, 10 AND 40 STAINLESS PIPE

Nominal Size	Schedule Number	Outside Diameter	Wall Thickness	Internal Cross-Sect. Area, Sq. In.	Wt. Lb. per Lineal Ft.
¾"	5	1.050	0.065	0.665	0.684
	10	"	0.083	0.614	0.857
	40	"	0.113	0.533	1.131
1"	5	1.315	0.065	1.103	0.868
	10	"	0.109	0.945	1.404
	40	"	0.133	0.864	1.679
2"	5	2.375	0.065	3.958	1.604
	10	"	0.109	3.654	2.638
	40	"	0.154	3.356	3.653
3"	5	3.500	0.083	8.730	3.029
	10	"	0.120	8.346	4.332
	40	"	0.216	7.393	7.576
5"	5	4.500	0.083	14.75	3.915
	10	"	0.120	14.25	5.613
	40	"	0.237	12.73	10.790



Pedestal mounted HC5 grinding casting

Because you only handle a light handpiece, not a heavy motor, Haskins Flexible Shaft Equipment can make fast work of those tough grinding jobs —with surprisingly little in labor cost. For this equipment is capable of delivering the sustained power needed for grinding castings, rough welded joints, sanding large areas or doing heavy scratch brush work.

Haskins has a complete line of attachments, too, for all grinding, sanding, filing or polishing operations . . . there's a unit to meet your specific requirements . . . do the job faster and more economically. Your choice of mounting—bench, pedestal or overhead. Write today for complete details. R. G. Haskins Co., 605 S. Washtenaw Avenue, Chicago 12, Illinois.

Suspended

Bench Mounted

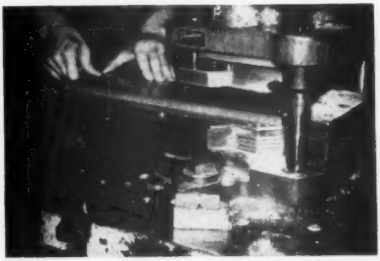
Pedestal Mounted

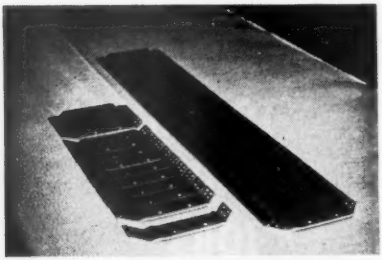
haskins
FLEXIBLE SHAFT EQUIPMENT

HASKINS

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

. . . Plastics, from page 78





Part:	Corner Support Gusset
for:	Westinghouse Household Refrigerators
by:	Kirby Company (Molding by Laminated Plastics, Inc., Cleveland, Ohio)
size:	3/16" thick x 1½" x 8"
holes:	Ten, .187 to .250
Operation:	Pierce and Cut-off
Rate:	1000 pcs./hr., stroking rate 60/min.
Normal lot:	25,000 pcs.
Quan. to date:	150,000 pcs.
Machine:	45 Ton Backgeared Cleveland Punch Press
Tool:	Progressive die, chrome carbon "Neore" steel
Punch Life:	Sharpen every 10,000 pcs.
Die Life	Probably regrind at 200,000 pcs.
Stripping:	Approximately 4000# spring load
Clearances:	2/3 normal clearance for steel
Allowances:	Punches are made .205", (.006 over desired hole size)
Finish:	Edges a little rough but quite clean and usable
Lubrication:	Oil on one side of stock to ease stripping action, reduce die wear, keep down dust
Accuracy:	Holes show .004" bell, hole size reduces from .187 to .183 during 10,000 pc. run.

made from these materials.

It is hoped that an acquaintance with some of the operations currently being done successfully, may help to show the range of operations which the designer can contemplate with confidence, and thus assist him to specify these new materials where they will serve him to advantage.

Some of these parts and the tools used to fabricate them are illustrated below, together with certain facts and figures on the operations involved. It should be noted that the tooling and speeds used for these operations do not differ materially from those already in common use on conventional materials. In general, the following comparisons apply:

Blanking and Shearing

1. Press capacity required is about half that required for the same operation in metal; about the same as for phenolics.

2. Sharp edges can be obtained up to $\frac{3}{32}$" stock, fair up to $\frac{5}{32}$", acceptable to $\frac{1}{4}$".

3. Die clearances should be half those specified for steel. Shear gibs should be snug and blades sharp; about the same as for phenolics.

4. Heated stock is neither required nor desirable.

5. Punched holes will be smaller than the punch by .002" to 0.10", depending on thickness and diameter. Blanked pieces will be larger than the die by .001" to .005".

6. Stripping mechanisms will require two to three times the loading used for steel blanking dies in order to overcome tendency of this material to grip the extended punches.

7. Die life between sharpenings will be about ½ that for steel and ¾ that for phenolics.

Drilling and Tapping

1. Rapid operations requiring much less power than for metals can be accomplished easily.

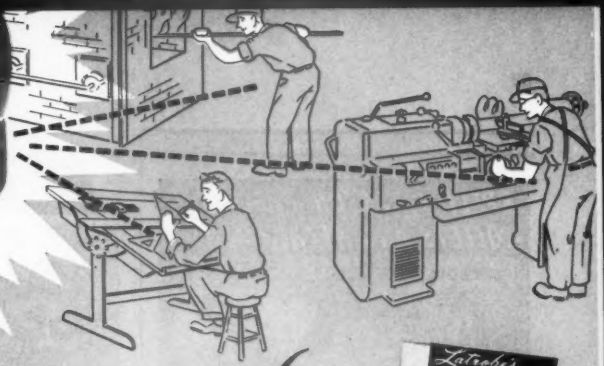
2. Smooth holes free from chipping and strong (⅓ that of steel) threads can be obtained.

3. Holes will tend to be larger than the drill by about .003" to .005" (more if not well guided).

4. Drill and tap wear will be quite rapid on first few pieces, then tend to stabilize.

5. Carbide-tipped drills with solid, firm

(continued on page 107)



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MOLYBDENUM

HIGH SPEED STEELS

*Trade Mark Reg. U. S. Pat. Office.

The foremost problem facing the metalworking industry today stems from the critical shortages that exist in many raw materials.

Sudden shifts from the use of old and familiar to relatively new and unfamiliar materials are sometimes necessary, therefore, to overcome these shortages and still meet the demands created by expanding production trends.

To assist the possible new—and the old—users of its Desegatized Brand molybdenum high speed steels—Electrite Double-Six, Electrite Tatmo, Electrite TNW, Electrite MV Series, and Electrite HV-6—the Latrobe Electric Steel Company has carefully compiled guides to their proper selection and use. These guides, in the form of pamphlets illustrated at the right, are complete and contain up-to-date information on the analyses, forging, hardening, tempering, testing, recommended uses and the available forms of each of these steels. Get in touch with your nearest Latrobe representative for copies or write direct to the main office in Latrobe, Pennsylvania.

And remember . . . . Latrobe's Desegatized Brand molybdenum high speed steels are fully uniform and free from harmful carbide segregates. This quality—found in all Desegatized Brand steels—guarantees greater tool and die efficiency—an important factor in your production program today!

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LATROBE, PENNSYLVANIA

BRANCH OFFICES AND WAREHOUSES: Boston, Buffalo, Chicago, Cleveland, Dayton, Detroit, Hartford, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, St. Louis, Seattle, Toledo.

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IMMEDIATE DELIVERY FROM STOCK

3AT, 3C
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5C

KLUTCH-KOLLET
Step collet for accurate chucking to 2¾" dia. Soft head for easy boring. Lowest price on market! Models 3AT, 3C, 5C.

480 (AC-50)

All collets in hexagon, square and round.

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LEVER-TYPE DRAWBAR ½" cap.

Positive grip on undersize, oversize or standard diameter work! Patented coordinate cams eliminate fingers.

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LIVE CENTER (Ball Bearing) Double sealed for accuracy.

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BUILD • and USE
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other production tools and
techniques.

22 Chapters — 272 Pages — over 200 illustrations, drawings, tables and charts.

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HUEBNER PUBLICATIONS
1971 Lee Road Cleveland 18, Ohio

. . . Metal Stitching, from page 76
bolting method took 135 seconds per joint. Metal stitching cut this time to 15 seconds per joint, which is a time saving

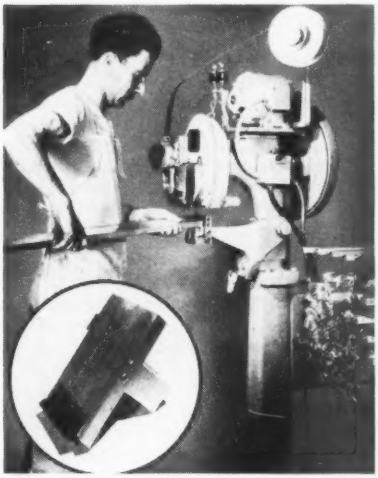

Photo courtesy Acme Steel Co.

Rubber feet are shown being attached to extruded aluminum ladder legs on an Acme-Morrison metal stitcher. Stitches are driven through a single layer of aluminum, two layers of rubber and clinched in a fraction of a second.

of over 85 per cent. Or conversely, the old method took 900 per cent more time than the present method.

The fact that these stitches form their own holes as they are driven eliminates drilling operations and the necessity for matching bolts to holes.

. . . Conserving Stainless, from page 84
gives a considerably larger inside diameter, and thus a larger internal cross-sectional area. The outside diameters of the pipes are identical, which facilitates the use of Schedule 5 with existing installations of Schedule 40 or Schedule 10 pipe.

More detailed information about Schedule 5 stainless pipe can be had from various producers. One mill, The Carpenter Steel Co., has issued a set of data sheets on Schedule 5. Copies can be secured from the company's Alloy Tube Div., Union, N. J.

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This new "Tool & Die Salvage Manual" of yours sounds like a very helpful book. Send me a FREE copy with the understanding that there will be no cost or obligation now or later.

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Firm_____
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City_____ State_____

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

. . . Maintenance Grinding, from page 58
etched on this plate from a stencil, prepared by typewriter, and eliminates the need of the grinder operator referring to the tool drawing. The etching instrument is produced by The Lectroetch Company of Cleveland, Ohio.

Prefer Non-Petroleum Type Coolant

Our preference for coolant is the non-petroleum type, forming a true solution and is supplied by the Quaker Chemical Company or the Stewart Oil Company.

We have used and discarded a number of so called soluble oils which form an emulsion. Experience has shown that a number of these either go rancid with a disagreeable odor in service or break down with resultant machine rusting. Quaker Grind #71 as supplied by the Quaker Chemical Corp. has a specific gravity of 1.05.

We use this to control the mixture and makeup of the coolants in the machines by using a sensitive hydrometer once a week. The recommended solution is one of coolant to 30 parts of water and the technical control gives us the correct mixture and resultant economy.

To accurately measure finishes in the super-finish class, a surface measuring instrument such as the Profilometer is desirable.

Plastic Faxfilm Method

There is, however, a simple method which may be used when such instruments are not available. This is the use of Faxfilm supplied by the Brush Development Company of Cleveland, Ohio. This is a plastic film, a piece of which is applied to the finished surface using a solvent. An impression of the surface results on the film and when placed in a projection comparator of the Jones & Lamson type at a 50 to 1 magnification, an image of the surface results.

The peaks and valleys of the surface act as prisms and break the light into its component colours. The greater the amount of colour in the image, the rougher the surface.

This Faxfilm method will indicate by comparison improvements in methods and is usable to eight micro inches. Since the American Standards Association publication on Surface Finish B46.1-1947, specifies commercial grinding limits, of 16.1 to 32 micro inch roughness, this process will indicate commercial and fine grinding, second class, having a limit of 8.1 to 16 micro inches.

To summarize, the use of a roughing and a finishing wheel in the manner specified will yield a surface of 1 micro inch in production grinding and this resultant surface has a life expectancy of 1¼ million parts in brass, 400,000 parts in nickel silver and varying amounts with steel before the burr limit becomes objectionable.

Controlling Amount of Metal Removed

The second phase of my talk concerns our means of control of the amount of metal removed from punches and dies during the sharpening process to extend the operating life of high production tools.

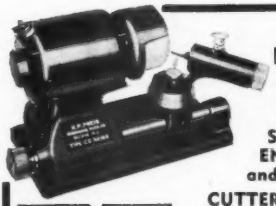
It appears that in the past we have tended to be concerned with the actual cost of the labour of regrinding tools, giving little or no thought to the value of the labour destroyed by excessive metal removal during the grinding process. An average cutting punch and die of tool steel costs $475.00 to make and has an operating life of ⅜" of an inch. It therefore follows that each thousandth of an inch is worth $1.25. An operator who grinds these tools without due consideration to the amount of metal removed may in a single day destroy die life and other men's work to the extent of 10 to 15 times his daily pay.

Our interest was aroused in this when we noticed work orders in the Grinding Dept. reading "Please remove .015" to Sharpen," and when we saw the grinder operator take a second cut across the dies for no apparent reason.

To control the amount of metal removed during the regrinding, methods have been developed which I will now present.

A wax impression is taken of the dulled edge of the punch and the die of each tool prior to sharpening. A small wafer of dental wax is pressed at a 45 deg. angle against the cutting edge of

(continued on page 106)



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$49.75 with 12 tap adapters No. 5 to ½"

Assures Good Threads
Maintains Correct Depth
3 Sizes
Free Folder

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Output is now at an all time high with our stocks now about 80% of "normal".

Deliveries of made-to-order material are averaging 90 to 120 days.

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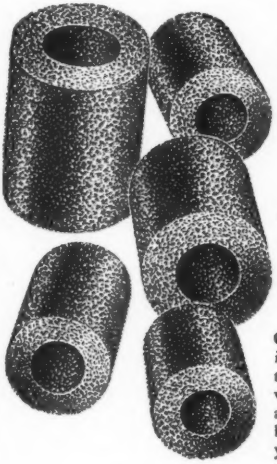

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Rapid Delivery

Advanced production methods assure you perfectly balanced Internal Wheels to meet rigid finishing requirements. Faster delivery... with overnight service for special jobs.

Chicago Internal Grinding Wheels produce better finishes with longer wheel life and cutting action. They're your best buy—"tailor made" to your specifications and speedily delivered.

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SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

PUBLICATION

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

Carborundum's New "61" Contact Wheel is featured in the company's latest folder. The publication shows why 50% more belt life can be obtained when the "61" is applied to abrasive belt backstand operations. It is liberally illustrated. THE CARBORUNDUM CO., Dept. T&P, Niagara Falls, N. Y.
Inform-A-Gram No. B1.

ABC Bushings, made of steel having a chromium and/or tungsten content, are described in a catalog and price list released by Accurate Bushing Co. The following types of drill jig bushings are included in this literature: headless press fit; slip renewable; fixed renewable; and head press fit.
Inform-A-Gram No. B2.

DESIGN LEADERSHIP IN DIE CUSHIONS

NONE BETTER
15,000 INSTALLATIONS
(There must be a reason)

For DEEP DRAWING
PAD CONTROL
KNOCK OUTS

Complete Engineering service at your disposal without obligation on all die cushion applications.

DAYTON ROGERS
Manufacturing Company
MINNEAPOLIS 7, MINNESOTA

"Modern" Cutting-Off Machines are described in a new 12-pager. These fully automatic, lathe type machines use standard bevel tool bits and will cut any material that can be turned. Stock of any length is fed through the spindle by double live feed rolls. Illustrations and detailed specifications are given in this bulletin. MODERN MACHINE TOOL CO., Dept. T&P, Jackson, Mich.
Inform-A-Gram No. B3.

The Weldon Measuring Attachment for Lathes measures directly the forward or reverse movement of the lathe carriage, within .001". It is easily attached to most lathes by drilling and tapping of one hole. This attachment saves time and reduces work spoilage. The manufacturer's Circular LA-1 gives complete details.
Inform-A-Gram No. B4.

General Shaft Straightening Attachments, for rough or finish straightening of centered or uncentered parts, are presented in Bulletin 396. This bulletin shows several standard models that can be mounted on General Flexible Power Presses. Specifications are listed. GENERAL MFG. CO., 6430 Farnsworth Ave., Detroit 11, Mich.
Inform-A-Gram No. B5.

Fourteen New Shapes have been added to the line of Grobet Rifflers, making the available number of shapes of these files over 126. Grobet File Co. of America, Inc., will honor all requests for Catalog AF-3.
Inform-A-Gram No. B6.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

The All-Purpose Monogram Furnace is described in a newly released bulletin. It is a small shop-type furnace that has many of the features of a large unit, including "Lite-Cast" refractories made in two sections for simple replacement. It is accurately controlled for exacting results. MONOGRAM PRODUCTS CO., INC., 731 N. 35th St., Philadelphia 4, Pa.
Inform-A-Gram No. B7.

Lucite and Plexiglas Plastic Sheets. Almac Plastics is distributing a stock and price list of available sizes, shapes and colors of plastic sheets, rod and tubing. ALMAC PLASTICS INC., Div. TD, 230 Fifth Ave., New York 1, N. Y.
Inform-A-Gram No. B8.

The New Edco Oiler Catalog illustrates and gives complete engineering data on oilers, vents, caps, tube forms, etc. Ten-page Catalog B-3 is procurable from EYNON-DAKIN CO., 1847 W. Bethune, Detroit 6, Mich.
Inform-A-Gram No. B9.

Graymills Pumps and Coolant Systems increase cutting speeds, improve quality of work and lengthen tool life. A new catalog describing various units is available from the manufacturer.
Inform-A-Gram No. B10.

The Newfield Universal Fly Cutter is presented in current literature. A single cutter, utilizing any type of standard high speed steel or carbide bits, makes multiple cuts in one operation.
Inform-A-Gram No. B11.

The Panto Model U-E3 Engraving Machine is a heavy-duty, bench type unit with interchangeable heads for engraving, electrical marking and acid etching. H. P. Preis Engraving Machine Co. is mailing an illustrated catalog.
Inform-A-Gram No. B12.

A New Medium Weight Drilling Machine. Sibley's E-25, is introduced in Catalog No. 69. It has a large rectangular table with coolant trough; variable speed drive for any size drill from ⅛" to 1"; 1½ hp axial air gap motor; and 25" swing.
Inform-A-Gram No. B13.

Severance CHATTERLESS TOOLS
HIGH SPEED CARBIDE
Winning their way on job after job, they are carefully designed to preclude chatter and can be depended on to produce superior finishes.
Severance CHATTERLESS COUNTERSINKS
STANDARD TYPE —
Stocked in 13 diameters up to 2" and in 30°, 41°, 45°, and 60° angles (with C/L).
Sizes 1" and larger stocked also threaded for shanks — tapered or straight — in various sizes.
Use CARBIDE for tough jobs or high production.
HEAVY DUTY TYPE —
Features larger shanks having a tang drive.
Full range of sizes and angles.
HEADQUARTERS FOR COUNTERSINKS, REAMERS, SEATING TOOLS, and SPOTFACERS that preclude chatter
Severance CHATTERLESS BALL SEAT REAMERS
Standard and Heavy Duty Types
8 sizes each.
Made also for shaped cavities — as ordered.
BALL NOSE DRILLS —
In corresponding sizes hog out the stock for Ball Seat Reamers.
Severance TAPER REAMERS
Faster cutting
Better finishing
Shear-cut teeth
Tapers up to 15° quickly supplied from stock — up to 1½" diameter x 2¾" long.
Unexcelled for holes having keyways, ports, splines, cross holes, etc.
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MIDGET MILLS
¼" Shanks
JUNIOR MILLS
LAB MILLS
DEBURRING GROUP
30°
45°
INSIDE
30° 45°
OUTSIDE
HAND RADIUS
TUBING GROUP
STANDARD Chamfering
SOLID

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

A 24-Page Catalog contains complete design specifications of the No. 2 Moore Jig Borer, describes jig borer accessories and gives many examples of jig borer jobs in the toolroom and on the production line.
Inform-A-Gram No. B14.

Your Engine Lathe can be converted to a turret lathe with the Jefferson 5-Tool Tail Stock Turret. Four sizes up to 24" swing are shown in a new folder from Jefferson Machine Tool Co.
Inform-A-Gram No. B15.

Precise Grinder-Millers provide accuracy to .0001" for cylindrical, internal, external and form grinding; and for milling with carbide or high speed steel midget mills. A complete, illustrated catalog is being distributed by Precise Products Co.
Inform-A-Gram No. B16.

A New 48-Page War Surplus Catalog, compiled by Groban Supply Co., includes welders, generators, pumps, etc. It contains photos, charts and instructions.
Inform-A-Gram No. B17.

A Specialized Service in manufacturing high-precision balls of any desired material, size and surface finish in large or extra-small quantities is announced in a bulletin from Industrial Tectonics, Inc. This bulletin lists standard and special balls available in various materials; shows typical tolerances; lists minimum quantities on special orders; describes the company's engineering service; and gives typical uses of ITI carbide balls. INDUSTRIAL TECTONICS, INC., 3684 Jackson Rd., Ann Arbor, Mich.
Inform-A-Gram No. B18.

The New Dahlstrom Tap Wrench is among the items described in a current pamphlet. Other machine shop specialties pictured and described are tap guides, tap chucks, tap adaptors and the Dahlstrom Light Duty Autostop (an adjustable, automatic stock feed stop). Prices of all products are listed. DAHLSTROM MFG. CO., 2508 W. Larpenteur Ave., St. Paul 8, Minn.
Inform-A-Gram No. B19.

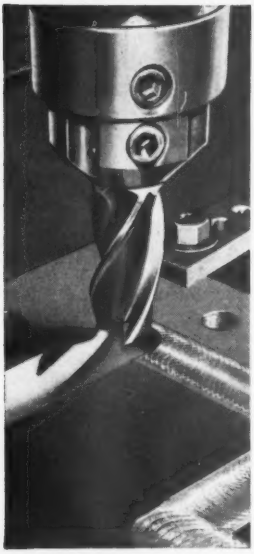
Index Model 55 Improved Vertical Mill has a speed range of 80 to 2700 rpm, combined with a 1 hp drive, 3¼" quill and extra-rugged spindle mounted on over-size precision ball bearings to give a capacity of ⅛" to 1½" end mills in steel. Descriptive literature has been prepared by Index Machine Co.
Inform-A-Gram No. B20.

Royal Oak Tool & Machine Co. offers its latest D-S Grinder Catalog. The D-S Radial Relief Grinder is available in hand-operated and motor-driven models for producing better cutting, longer-lived taps, counterbores, step drills, center drills, etc.
Inform-A-Gram No. B21.

YESTERDAY'S PIONEER . . . TODAY'S LEADER

NEW HEAVY DUTY END MILLS and HOLDERS

(Both are Stock Items)



● Look at this rugged 2" diameter Weldon end mill with 4" long flutes which made a 2½" deep cut in a solid block of die steel—4140 steel heat treated to 260 Brinnell. The feed was 1½" per minute, and the material was removed at a rate of 7½ cubic inches per minute.

This HEAVY DUTY Weldon end mill is held by a new-style end mill holder which bolts securely on to the nose of the milling machine spindle. The holder, located by a centering plug, is driven by two drive keys on the spindle nose. The 2" diameter shanks of these heavy-duty end mills are securely held by two large hollow head screws.

For top performance and sturdy long life in end mills—large or small—look to Weldon.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

SEND FOR LATEST CATALOG NO. 10

THE WELDON TOOL CO. Cleveland 4, Ohio

3000 WOODHILL ROAD

Various Pigmented and Non-Pigmented Stamping Compounds are fully described in a series of bulletins published by Pillsbury Chemicals. These compounds can be used in many applications, such as the drawing of stainless steel, carbon steel, aluminum, etc. The bulletins give characteristics together with information on diluting, mixing, cleaning and applying. PILLSBURY CHEMICALS, 6545 Georgia Ave., Detroit 11, Mich.
Inform-A-Gram No. B22.

The Newman Speed Reducer is a multiple-speed attachment that is valuable wherever drilling, tapping and reaming are done. It reduces spindle speed from 1725 rpm to as low as 100 rpm. Louis Newman Machinery Co. will supply details and prices.
Inform-A-Gram No. B23.

The Latest Behr-Manning Bulletin pictures several economical and speedy applications of mechanical polishing coated abrasives. To get your name on the mailing list for this interesting publication, write to BEHR-MANNING CORP., Dept. T&P, Troy, N. Y.
Inform-A-Gram No. B24.

The Buck "Ajust-Tru" Chuck features .0005" precision with scroll chuck rechucking speed. It handles collet and step collet work and is adaptable to dividing heads, grinders, screw machines and lathes. A descriptive brochure is being sent out by Buck Tool Co.
Inform-A-Gram No. B25.

The Sheldon Precision Lathe Catalog covers design and operation features that permit the Sheldon Lathe to handle the great bulk of everyday toolroom and die shop jobs.
Inform-A-Gram No. B26.

All Types of Holding Fixtures for machine shop production are designed and built by Swartz Tool Products Co., Inc., There are 75 models and fixture sizes from which to choose. Catalog 941 gives all the facts.
Inform-A-Gram No. B27.

Lufkin No. 900 Master Planer Gage features perfectly fitted slide and base. Slide slot is beveled and ground to eliminate side play, assure accuracy. Details are procurable from The Lufkin Rule Co.
Inform-A-Gram No. B28.

T-Nuts and Stud Sets, step block sets, punch press sets, jig feet, screws, hand knobs and many other tool specialties are described in the extensive catalog published by Northwestern Tool & Engineering Co.
Inform-A-Gram No. B29.

Eleven New End Mill Types were recently introduced by Putnam Tool Co., bringing the total number of available standard sizes and types to over 1000. The latest Putnam catalog is offered.
Inform-A-Gram No. B30.

DEALER
Order
MOTCH & MERRYWEATHER
SLITTING AND SLOTTING SAWS
SOLID AND SEGMENTAL CUT-OFF BLADES
from your Local Dealer
OR FROM OUR PLANT IN CLEVELAND . .
COMPLETE RANGE OF SIZES • PROMPT DELIVERY
THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING • CLEVELAND 13, OHIO
COMMAND OUR UNPARALLELED EXPERIENCE IN CIRCULAR SAWING
MMM

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Norbide Abrasive can be used successfully in the lapping of carbides and other hard materials where other manufactured abrasives do not remove stock quickly enough for economical production. Norton Company's Bulletin No. 559 gives complete information and prices.
Inform-A-Gram No. B31.

Onsrud Air Turbine Grinders are designed for vibration-free operation that reduces operator-fatigue. Three models are shown in current Onsrud literature.
Inform-A-Gram No. B32.

Balas Collet Catalog. A detailed catalog of collets, pushers, pads and other machine tool accessories has been compiled by Balas Collet Mfg. Co. It pictures, describes and lists prices for the complete Balas line, and gives suggestions for use and application to various machine tools.
Inform-A-Gram No. B33.

Tamms' Blue Layout Dope speeds layout on all metals. Samples and descriptive literature are procurable from the manufacturer.
Inform-A-Gram No. B34.

"Dos" and "Don'ts" of Sound Procedure in using All-State Silver-Brazing Alloys are outlined in a new issue of a miniature folder that has been released on the All-State dispenser for these materials. The rules, while simple and brief, should be especially helpful to those turning to the silver solders to replace harder-to-get, more critical materials. ALL-STATE WELDING ALLOYS CO., INC., 273 Ferris Ave., White Plains, N. Y.
Inform-A-Gram No. B35.

The Odee-HONE is a single tool for the accurate honing of all parts from ½" to 2½" diameter. For all types of external, cylindrical surfaces, the Odee-HONE generates accurate size, roundness, straightness and finish on die pins, spindles, shafts, guide pins and bars, pistons, rollers, plungers and other similar parts. Complete information is procurable from the manufacturer, Micromatic Hone Corp.
Inform-A-Gram No. B36.

Denison Multipress Advantages are detailed in current literature. A typically accurate job that the Multipress performs is the high-production swaging at .0004" tolerances of tiny watch part tips at the Elgin National Watch Co. In this application, an 8-ton Multipress, equipped with a 6-station indexing table, is used.
Inform-A-Gram No. B37.

"Pantography" is a new George Gorton booklet that fully explains this process and shows what Gorton Tracer-Controlled Pantographs can do for you. With these special machine tools, literally thousands of operations can be speeded up, improved in quality and lowered in cost.
Inform-A-Gram No. B38.

AT YOUR FINGERTIPS

A must for your bench — Horberg Drill Size, Pin Gages. Unlimited time and cost saving advantages in center and location finding, hole or slot gaging.

- Held Accurate to +.0001 −.0000
- Concentric tapered to fit holes .0012 smaller than gage size.
- 1½" in length for easy insertion
- Highest quality oil hardened tool steel
- In convenient indexed stand for quick selection

Letter sets of 52 gages, A-Z in pairs
Fraction sets of 60 gages, 3/64" to 1/2" in steps of 1/64" in pairs
Number sets of 120 gages, 1 to 60 in pairs
Individual gages in stock
Extra stands available

All Items Stocked for Immediate Delivery

FROM THE Horberg GAGE COMPANY
29 STAPLES ST., BRIDGEPORT, CONN.

Quantity
..... Letter Sets @ $45.
..... Fraction Sets @ $30.
..... Number Sets @ $90.
..... Single gages @ $ 1.
..... Stand alone @ $10.

Please Rush checked items and literature to
Company.....
Address.....
Name.....
Title.....

The New American Drill Jig Bushing Catalog and price list shows various types and sizes of these bushings, lists drill sizes with their decimal equivalents. Other useful technical information is also included. This attractive catalog is printed on heavy, durable stock to withstand frequent reference usage. AMERICAN DRILL BUSHING CO., INC., 5107 Pacific Blvd., Los Angeles 58, Calif.
Inform-A-Gram No. B39.

Economical Presses for forming, bending, trimming, broaching, riveting and press-fit assembly work are covered in Hannifin's brand new Bulletin No. 135. Complete descriptions, specifications and dimensions are given for 5-ton and 8-ton all-purpose hydraulic presses in this illustrated publication. HANNIFIN CORP., 1101 S. Kilbourn Ave., Chicago 24, Ill.
Inform-A-Gram No. B40.

Special Boring Bars for precision work can be equipped with standard Microbore Tools. Each tool is independently adjusted by proved micrometer, vernier principle. DeVlieg Microbore Co.' will mail a detailed catalog upon request.
Inform-A-Gram No. B41.

The Magna-Sine provides positive accuracy for any angular setup, whether single or compound. The current Magna-Sine catalog is being sent out by Omer E. Robbins Co.
Inform-A-Gram No. B42.

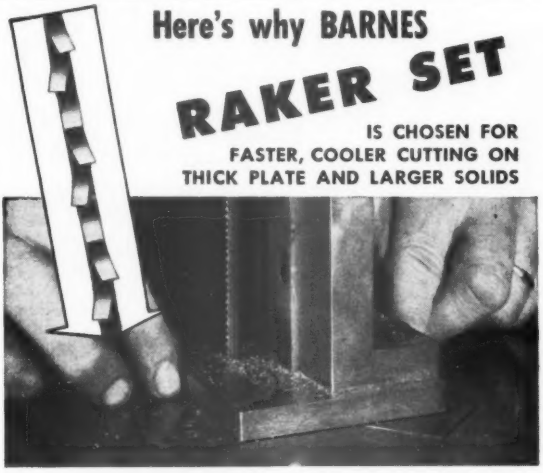
"Quality" Dies, completely and exhaustively inspected at every step in the diemaking process to make sure that the dies are right, are the subject of Quality Hardware & Machine literature.
Inform-A-Gram No. B43.

"Star-Dust" Diamond Lapping Compounds are now available in cartridges to fit a special "Applicator Gun," according to literature from Ace Abrasive Laboratories. The new gun delivers accurate minimum quantities to the job without waste or contamination.
Inform-A-Gram No. B44.

Catalin Tooling Resin can be used in every phase of sheet fabrication to cut tooling costs and save production time. Data sheets and samples are procurable from Catalin Corp. of America.
Inform-A-Gram No. B45.

Dovetail Cutters, for use in Reltool and other standard end mill holders, are now available from Reltool Corp. stock. These tools, for milling dovetails with less setup time and easier handling, are described in Reltool's comprehensive, 176-page Catalog No. 50.
Inform-A-Gram No. B46.

Drilling Holes of various shapes by an inexpensive method is explained in the latest catalog of Watts Bros. Tool Works. Square, triangular, pentagonal, hexagonal and octagonal holes can be drilled.
Inform-A-Gram No. B47.



Here's why BARNES RAKER SET IS CHOSEN FOR FASTER, COOLER CUTTING ON THICK PLATE AND LARGER SOLIDS

Raker Set, because of its design, assures a fast cutting rate. Each tooth cuts a full chip, thus less heat is generated. Raker Set retains saw kerf width, combines strength with more efficient chip clearance where most cutting is on larger solids or thick plate.

See your Barnes Distributor for dependable saw blades and dependable technical advice.

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ESTABLISHED 1919
W. O. BARNES CO., INC.
1297 TERMINAL AVE. • DETROIT 14, MICH.

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Johnson Metal Cut-Off Band Saws will quickly pay for themselves and give trouble-free service year after year. Descriptions of various models are contained in the manufacturer's latest literature offering.
Inform-A-Gram No. B48.

Perkins Model No. 650 B Press. Improved features of this press are detailed in a new bulletin. These include tie rods shrunk in frame for extra rigidity; higher die space with greater depth of throat and larger bed area.
Inform-A-Gram No. B49.

The Feedmaster Automatic Air Feed is presented in a circular from Great Western Tools, Inc. Prominent features are described and typical examples of everyday automatic feeding operations are pictured.
Inform-A-Gram No. B50.

The Heavy Duty Shoplifter now has new accessories that make it easy for one man to move heavy dies up to 2000 lbs. from storage rack to inclined bed of press. Economy Engineering Co. will supply literature.
Inform-A-Gram No. B51.

TRIPLE PURPOSE MACHINE
FILES...SAWS...STONES
ILLINOIS DIE FILING MACHINE
An accurate, smoothly-operating machine that files, saws and stones the most intricate die shapes . . . eliminates tedious hand operations . . . reduces costs. It is quality-built for long, trouble-free service . . . hardened and ground shafts running in bronze bushings minimize wear. The holding chuck and clamping device provide perfect file alignment.
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Write for descriptive literature
Stoning
ILLINOIS TOOL WORKS
2501 N. Keeler Ave. • Chicago 39, Ill.
MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

Kasson Precision Collets and Attachments are available for immediate delivery from stock. A featured item in the line, the "Klutch-Kollet," is a step collet for accurate chucking to 2¾" diameter. It has a soft head for easy boring. Complete details on these machine tool attachments are included in literature offered by the manufacturer, General Die and Stamping Co.
Inform-A-Gram No. B52.

The B & L Balphot Metallograph is painstakingly described in new Catalog E-232. Included in this 20-page booklet are many illustrations and descriptions of the various features of this new metallograph, together with full specifications and a price list. BAUSCH & LOMB OPTICAL CO., Dept. T&P, Rochester 2, N. Y.
Inform-A-Gram No. B53.

Milne's Kolorkote Hollow Die Steel is described in a current catalog. For any given finished sizes, Milne Hollow Die Steel weighs 13 to 20% less than corresponding ring forgings. It is stocked in three grades, in sizes from 16" OD x 12" ID to 2" OD x 1" ID. This steel is full-length spray-painted with permanently identifying color.
Inform-A-Gram No. B54.

The Mead Industrial Air Power Catalog is full of suggestions for faster, cheaper production. It describes and pictures air-operated presses; air vises, air cylinders, work feeders, midget air clamps and many other cost-cutting devices.
Inform-A-Gram No. B55.

Complete Fixture Clamp Assemblies or any component parts are made by West Point Mfg. Co. Template drawings of all clamps and parts will be sent upon request.
Inform-A-Gram No. B56.

Three New Hi-Speed Automatic Presses are described and pictured in Di Machine Corporation's latest literature offering. These efficient and accurate presses are made in 5-, 8- and 12-ton models, featuring variable speed drive, clutch and automatic brake release, and positive knockout for compound dies.
Inform-A-Gram No. B57.

The Lectroetch Stencil Printer uses regular printer's type for emergency and short-run marking. Stencils will mark finished precision metal parts quickly, without burrs, strain or deformation with the Lectroetch Stencil Process. Detailed literature is obtainable.
Inform-A-Gram No. B58.

Zagar Engineering Manual No. 1 includes dimensional drawings and detailed data on all models of broaching machines, collet fixtures and multiple spindle, gearless drill heads. Also contained in this publication are several action photos.
Inform-A-Gram No. B59.

The Air Master Dust Collector will keep dust and grit out of your plant. It instantly sucks dust particles from the whirling wheels of grinders and buffers. The manufacturer, Cincinnati Electrical Tool Co., has released descriptive literature.
Inform-A-Gram No. B60.

The Baldor Carbide Tool Grinder is presented in a current folder. Price of this grinder includes everything needed to sharpen carbide tools quickly and accurately.
Inform-A-Gram No. B61.

Hardened and Ground HSS Blanks in any decimal diameter to ½", and in any length, are covered in Price List D-1 from William T. Hutchinson Co.
Inform-A-Gram No. B62.

The Atlas Milling Machine handles the full range of milling operations—slabbing and facing and end milling, keyways, finishing, and layout work. Atlas Press Company's extensive catalog gives full particulars.
Inform-A-Gram No. B63.

Model A "RFC" Roll Feed is suitable for 4-, 6- and 8-ton power presses. It cannot slip and it reverses instantly. Literature covering the complete "RFC" line can be had from Roll-Feeds Corp.
Inform-A-Gram No. B64.

A Labor-Saving Device for the detail marking of name plates is the "Automark" Electric Metal Marking Typewriter. It is all-electric, with automatic table feed. Cadillac Stamp Co. will provide a detailed bulletin.
Inform-A-Gram No. B65.

Benchmaster's 4-Ton Deep Throat Punch Press provides extra reach for oversize workpieces. This newly improved model is described in a circular released by the California manufacturer.
Inform-A-Gram No. B66.

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Bolster and T-Slot Types

Don't trust valuable dies and fixtures to inferior Bolster and T-Slot Bolts.

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Made to JIC specifications. T-Bolts and Bolster Bolts are forged, machined and heat treated to the necessary specifications and more than meet the 149,500# tensile strength required.

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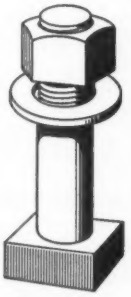
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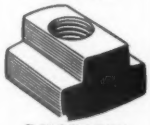
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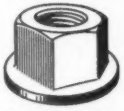
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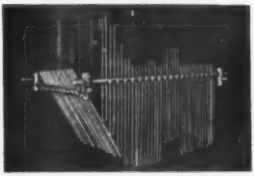
for Power Presses



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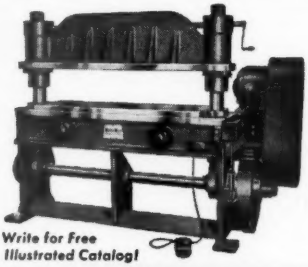

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3-E Lubricant, now being marketed by Wayne Chemical Products Co., substitutes for white lead on lubricating jobs. It is non-poisonous, and lighter in weight and less expensive than the commonly-used white lead. Detailed information is procurable.
Inform-A-Gram No. B67.

750,000 Drill Bushings in Stock are your assurance of prompt service from Ace Drill Bushing Co. The manufacturer offers descriptive literature on these durable bushings, which are precision made and light-wave tested for .0003" maximum tolerance.
Inform-A-Gram No. B68.

Air-Operated Dial Feed Tables are described in The A. K. Allen Company's latest illustrated brochure. Models 11EA and 11EB feature completely enclosed working mechanism, rack and gear drive, and flame hardened working parts.
Inform-A-Gram No. B69.

Anyone Can Read the new Read-Rite Micrometers. These and other measuring tools are shown in the 12-page Catalog 30, issued by The Central Tool Co.
Inform-A-Gram No. B70.

The Walls Manual on Finishing contains descriptions of the company's Standard D-4 Abrasive Band Grinder and other styles and sizes.
Inform-A-Gram No. B71.

Illustrated Bulletin No. 24 points out construction features, dimensions, specifications and prices of Cardinal's Type B Speed Vise.
Inform-A-Gram No. B72.

Standard Jig and Fixture Parts are presented in an interesting, 52-page book of drawings, specifications and prices issued by Noble & Stanton, Inc.
Inform-A-Gram No. B73.

An Illustrated Bulletin on the Wilder "Vertical Design" Micro Projector has been published by George Scherr Co., Inc. This projector features a comfortable inclined screen, micrometer cross-slide adjustments, and optical projection that always detects errors.
Inform-A-Gram No. B74.

High Speed's Staking Machine can handle any job of staking or riveting fixed or movable joints; anything in eyeletting, burring, etc. Complete details can be secured from High Speed Hammer Co., Inc.
Inform-A-Gram No. B75.

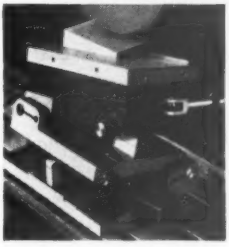
Style "S" Sure-Grip Master Collets and Pads are described in a new Hardinge bulletin. They are available for all sizes of several makes of multiple spindle automatics up to and including 3½" capacity. They come in round, hexagon and square shapes.
Inform-A-Gram No. B76.

Socket Screw Products, cap and set screws, nuts, taper pins and studs are designed by The Chicago Screw Company to give you a tighter, lower-cost fastening for any heavy-duty purpose. Literature can be had upon request.
Inform-A-Gram No. B77.

ANGULAR SET-UPS

to gauge-block accuracy

IN A FEW MOMENTS



the Magna-Sine

Any angular set-up, single or compound, takes only the time to look up the angle in the Robbins Table of Constants and to insert the indicated gauge blocks between the Magna-Sine plates. It's fast—it's positive, to gauge-block accuracy. Work is held by magnetic attraction. In two models and two sizes; also in non-magnetic models for inspection work.

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SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

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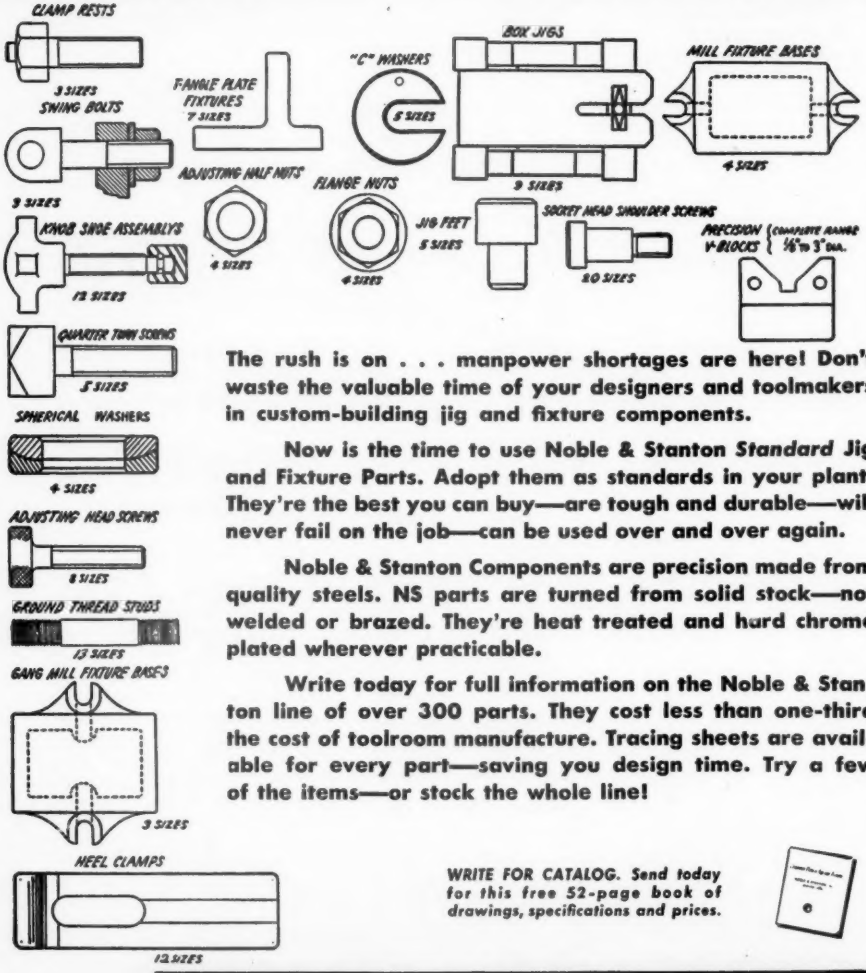

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Pittsburgh Tool Steel Wire Co...61
Phoenix Machine Co., The....148N
Pratt & Whitney Division, Niles-Bement-Pond Co.....35
Preis Engraving Machine Co., H. P.....91A
Putnam Tool Company.....1

Raymac Mfg. Co., Inc.....114A
Reid Brothers Co., Inc.....136C
Reid Tool Supply Company....126B
Reltool Corporation.....115B
Rice Pump & Machine Co.....130A
Robbins Co., Omer E.....101
Roll-Feeds Corporation.....124A

Scherr Co., Inc., George.....130B & 137B
Schraner & Co., A. P.....148P
Scientific Lubricants Co.....142B
Service Machine Co.....130D
Severance Tool Industries, Inc...93
Shore Instrument & Mfg. Co...145C
Standard Electrical Tool Co...158A
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Strand Co., Edward D.....114B
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Tamms Industries, Inc.....157C
Tannewitz Works, The.....109
Thermo Electric Mfg. Co.....133B
Thomas Machine Mfg. Co.....125
Tomco Products Co.....88B
Tubular Micrometer Co.....71
Twentieth Century Mfg. Co.....137A & 146A

Universal Engrg. Co.....141

Vanadium-Alloys Steel Co.....21
Verson Allsteel Press Co.....13

Wales-Strippit Corp.....28
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Watts Brothers Tool Works..140B
Weldon Tool Co., The.....94
West Point Mfg. Co.....99
Wheelock, Lovejoy & Co., Inc. 147B
Whistler & Sons, Inc., S. B.....43
Whitney Metal Tool Co.....150B
Wirth & Son, Inc., Carl.....129B
Wittek Mfg. Co.....30

Yost Mfg. Co.....137D

Zagar Tool, Inc.....105

INFORM-A-GRAM KEY NUMBERS

Army-Industry Research Center

Plans for construction of a Tank-Automotive Research Center in the Detroit area recently were announced by the U. S. Army.

Available to industries engaged in defense work as well as the Armed Forces, the center will be located adjacent to the Army Ordnance Corps' arsenal in Center Line, Michigan. It will consist of a cluster of functionally designed, interconnected buildings that, together with existing facilities, will comprise a complete testing and research center for tank and automotive work.

When completed, the center will be a culmination of years of joint planning by the automotive industry and the Ordnance Corps.

During World War II, Colonel J. M. Colby, then Chief of the Development and Engineering Department, formed an ordnance committee composed of both military and civilian engineers to study the requirements of an ordnance automotive laboratory and to make tentative plans concerning equipment, personnel and space requirements.

In July, 1945, the Chief of Ordnance requested the president of an automotive company to form a committee of key people from the industry to review the planning of the ordnance committee. The two committees, working together, made up a firm plan for the organization and construction of an Ordnance Automotive Laboratory capable of making complete tests of all the components of military vehicles.

Parts of this plan were carried out, but due to the lack of funds following World War II the entire program could not be completed.

Last December, however, Brigadier

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AIR-MITE now supplies solid steel upright columns in any lengths required to give you these important flexibility features:

1 Normal ram clearance of 0" to 6" may be increased to any clearance required for special application.

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Chicago 24, Ill.

KENNAMETAL INC., Latrobe, Pa., has received a $4,105,281 contract from the Pittsburgh Ordnance District for production of 76mm cemented tungsten carbide armor-piercing projectiles. The company turned out large quantities of similar high-velocity shot during World War II which were effective in destroying heavily-armored tanks.

General David J. Crawford, Commanding General of the Ordnance-Automotive Center, requested members of the Automobile Manufacturers Association to form another committee to recommend additional facilities in the light of advances made during the last six years. The general outline of their recommendations has now been approved.

At present, the Development and Engineering Department of the Tank-Automotive Center employs more than 1000 persons. The staff is now being increased by nearly 20 per cent.

The entire Engineering and Development Department works in close coordination with the manufacturing department's Production Engineering, with the Field Service Department for preparation of essential lists of parts, catalogs and technical manuals, and with the National Production Department for engineering assistance to commercial manufacturers of tank - automotive equipment.

Such coordination of effort, both within the Army and between the Army and the automotive industry, has made American military vehicles the finest in the world.

★ ★ ★

Gray Iron Founders' Society has announced the opening of its 1951 Redesign Contest. The award program gives recognition to those who submit the latest examples of the redesign of component for production in gray iron. Prizes totaling $350 will be given this year to the top winners. First award is $200.

Norton Plans $6,000,000 Grinding Machine Expansion

An expansion plan costing $6,000,000, increasing Norton Company's capacity to make grinding and lapping machines, has been announced by Milton P. Higgins, president of the Worcester, Mass., firm.

To meet the demands of the present defense effort, a new 6½-acre plant will be erected. It will consist of a 740-foot by 300-foot factory joining a 360-foot by 100-foot office building. The unit will provide 275,000 square feet of working space and enlarge the company's machine tool manufacture by 50 to 60 per cent.

The cost figure includes plant, office and equipment. Much of the latter will be new. Construction will start this month.

HOLES for sale
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PROMPT DELIVERIES
Zagar GEARLESS Drillhead, 12", 24-spindle drillhead; capacity to 5/8" in steel.
• For sale: low-priced holes, yet perfect and highly profitable! Drill many hundreds of holes at one pass—any number of spindles—any material (steel, glass, plastics, acoustical tile, etc.)—any pattern—as close as twice drill diameter. Adaptable to any standard drill press or designed as complete unit. A new high in production, a new low in cost. Send us your part drawing now for quick quotation.
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TOOLS FOR INDUSTRY and SPECIAL MACHINERY

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

. . . **Maintenance Grinding, from page 90**

the tool. This wafer held in the stylus is then placed in a Jones and Lamson comparator and an image at a 50 to 1 magnification is presented. A dulling of .005" is shown as an arc having a ¼" radius. Over the screen of the comparator, a grid has been placed having lines of .100" separation scribed on this plate.

By means of this, the dulling is read directly from the image to the nearest thousandth of an inch. This is specified as the amount of metal removal on the work order. Final control lies in the hands of the tool inspector who measures and records the die life before and following each regrind.

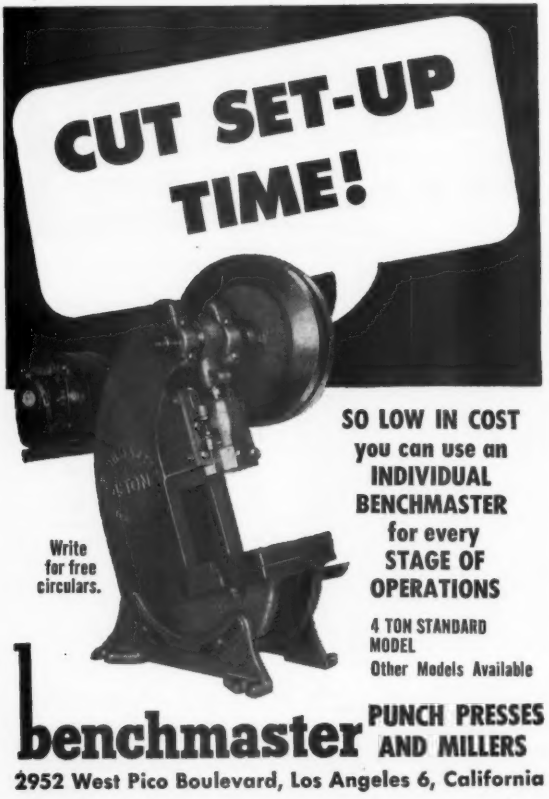
By the control of the amount of metal removed when sharpening, we have extended the operating life of high production tool steel punches and dies by three times their former life expectancy. This has had the end effect of decreasing our tool replacement and in effect a tool which formerly cost us $425.00 to build, now costs us $160.00.

This of course holds true with high production tools that have a life expectancy and does not apply to tools with which the part becomes obsolete before the tool life is expended. It is our practice to measure each and every tool regardless of its classification before grinding.

★ ★ ★

Spray Painting School

The following schedule of classes in industrial spray finishing methods at the School of Spray Painting operated by the DeVilbiss Co., Toledo, Ohio, is again being offered on the company's long-established policy of making no charge for instruction: July 16; August 13; September 17; October 15; and December 10. Users of DeVilbiss equipment may make application now to enroll their spray operators, shop superintendents and service managers for any of the one-week courses scheduled. Enrolees pay only for meals and lodging while attending school. Information or applications for classes can be obtained from DeVilbiss Co., Toledo, O.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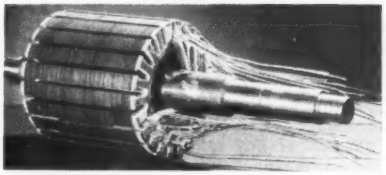
. . . Plastics, from page 86



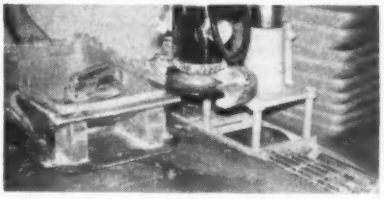
fixtures should be used for production drilling.

6. Tapping must be done very carefully to avoid false cutting and severe weakening of threads. Automatic feed is essential on production work.

7. Wet operation will greatly prolong tool life and eliminates any dust problem.

8. Vacuum dust removal is essential for dry operations on production scale.

9. Drilling parallel to laminations must be done cautiously to avoid delamination just as with phenolic laminates. Drill should be kept sharp and the feed should not be forced. Where possible, tight clamping of opposite faces will permit much faster work.



Part:	Film Magazine Cover
for:	Ryan Industries Aircraft Camera
by:	Laminated Plastics, Inc., Cleveland, Ohio
size:	1/16" thick x 14" x 22"

Part:	End lamination blanks
for:	Reliance Electric Motor Armatures
by:	Reliance Elec. (mat'l by Laminated Plastics, Inc., Cleveland, Ohio)
size:	3/32" x 6" dia.
holes:	One 1½" dia.
Operation:	Blanking
Rate:	500 pcs./hr., stroking rate 45/min.
lot:	Usually 200 to 500
to date:	15,000
Machine:	Cleveland Inclinable #91—75 Ton
Tool:	High carbon chrome nickel, compound die
Stripping:	50% more than for 18 gauge steel
Clearances:	Same as for steel
Lubrication:	None
Note:	These dies are usually run on both steel and PLASTIC in the same set up since some parts of each are required together in the armature assembly. No changes are required in the press setting or operation.

Saw Cutting—Rotary Blade

1. Clean, smooth edges are easily obtained at rapid speed.

2. Wet cutting is far superior to dry because of greater speeds and less power required and elimination of otherwise difficult dust removal problem.

3. Abrasive wheel cutting is appreci-

(continued on page 112)

Operation:	Saw Trimming Flash Edge
Rate:	30 pcs./hr., feed 20 ft./min.
lot:	100 pcs.
to date:	2000 pcs.
Machine:	DeWalt Model GD Table Saw, 2HP, 3600 RPM, Custom Table
Tool:	Di Met Rimlock 12" dia. Steel blade, 3/32" thick
Life:	Anticipate 3000 pcs. (18000 lineal ft.)
Lube:	Stream of water on blade
Accuracy:	Plus or minus 1/32
Finish:	Smooth edge without fuzz or delamination.

Controlled Materials Plan and the Defense Program

Beginning with the third quarter of the year, effective July 1, 1951, the Controlled Materials Plan goes into operation. This plan—popularly known as CMP—has been adopted by the National Production Authority to deal with the problems of a dual economy. The purpose of CMP is to assure a balanced flow of essential production and construction with a minimum of interference to the civil economy. Controlled materials at this time are steel, copper and aluminum.

A priority system is not adequate to insure that essential production and construction are completed on schedule. Production is a continuous process; for instance, all parts and components of a tank must be produced and on hand when needed, or productive effort is wasted and our defense jeopardized.

Accordingly, CMP has been adopted as the best method to assure that our efforts are in balance and undelayed. CMP ensures that materials and components are available for defense and defense-supporting projects.

Furthermore, CMP provides the facts and figures on supply and demand of key materials and components that make it possible to strike a better balance between demand and supply of controlled materials for non-defense uses.

With CMP it is possible to determine material needs, and to program essential production and allocate the required materials. It is then possible to measure the balance of key materials remaining for non-programed production and to employ other NPA controls, such as (limitation) orders, to effect a measure of balance between non-defense demand and the remaining supply.

CMP poses the problems of a great deal of paper work. It will take time for the plan to reach a smooth level of operation (based on World War II experience, the first quarter under CMP is largely a fact-gathering and testing period).

In order to make CMP procedures as simple and efficient as possible, all products using CMP materials are classified into "A" and "B" products. But while all such products are classified, not all of them will be included in the CMP programs.

For classification purposes, "A" products are those products of special design or for special use which are sold to one or relatively few customers. As a result, it is convenient to gather requirements data and allot materials for "A" products vertically, that is, directly from customer to consumer, or manufacturer.

Products	Symbols	Products	Symbols
Air Craft	AIRC	Leather and Leather Products	LEAT
Agricultural Machinery and Implements	AGRI	Lumber and Lumber Products	LUMB
Aluminum and Magnesium	ALUM	Miscellaneous Metals and Minerals	MSMIV
Building Materials	BLDG	Motion Picture—Photographic Products	MOTP
Chemicals	CHEM	Motor Vehicles	MOVH
Communications Equipment	COMM	Ordnance and Shipbuilding	ORD & SHH
Construction and Mining Machinery	CAMC	Petroleum Administration for Defense	PAD
Consumers Durable Goods	CDGS	Printing and Publishing	PRIN
Containers and Packaging	CONT	Pulp, Paper and Paperboard	PAPR
Copper	COPR	Railroad Equipment	TRAN
Electrical Equipment	ELEC	Rubber	RUBR
Electronics	ETRX	Scientific and Technical Equipment	SITE
Engine and Turbine	ENGN	Service Equipment	SERV
General Components	GCON	Textile	TEXT
General Industrial Equipment	GIEQ	Tin, Lead and Zinc	TLZ
Iron and Steel	STEE		

Information is passed up the line from supplier to direct customer, while authorized schedules and allotments are passed down. Most military products, being of special design, are "A" products—the tank and its specially designed assemblies are examples. Auto frames, made for one company, are an example of a non-military product classed as an "A" product.

"B" products, on the other hand, are those of general design, sold to many customers or through many outlets, where it is not convenient or efficient to pass on materials allotments from each customer to the "B" product producer. Manufacturers of "B" products included in the CMP program present requirements data to, and receive schedules and allotments directly from, the appropriate NPA Industry Division.

The principal points of contacts for producers of "B" products who are affected by CMP directly or indirectly are given in the acacompanying Industry Divisions Table.

For classification purposes, the "B" list includes a wide range of common components and parts, such as nuts and bolts, ball bearings, fractional horsepower motors; and it includes the standard civilian products using CMP materials, such as automobiles, appliances, farm and office equipment.

An official CMP Class "B" product list has been prepared and is now available from any of the 13 regional and 90 field offices of the U. S. Department of Commerce located throughout the country.

This list is to be used by a "B" product manufacturer when making an application for an allotment of controlled materials. The list is tabulated by Product Class Code Number, Product, and NPA Division Code Letters. For instance, the first product listed appears thus; 19510 —Small Arms, Civilian—ORD.

19510 is the Product Class Code; Small Arms, Civilian, is the product; and ORD is the NPA division (Ordnance). Rifles, revolvers and shot guns are some of the items included in the class of small arms.

If a manufacturer of hunting rifles and

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Cutting Hard-Tempered 1/8" Chrome Moley Steel
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FRICTION sawing with Tannewitz High Speed Band Saws results in perfectly amazing time savings in the cutting of flat sheets of soft or hardened steels, non-ferrous metals, armor plate, glass, plastics, many other materials and the trimming of castings. For cutting formed parts there's nothing to compare with it. The down-drag of the saw is so negligible that parts may be trimmed or sawn as desired without using a rest of any kind. Whatever your cutting requirements, chances are they can be handled faster and at less cost with Tannewitz High Speed Band Saws.
THE TANNEWITZ WORKS
GRAND RAPIDS, MICHIGAN
Write for Your Free Copy on Friction Sawing
FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

also ball bearings were applying for an allotment of controlled material for the third quarter of 1951, he should have had his applications filed May 31st; one application for his hunting rifle production requirements and one for his ball bearing production. In the proper spaces provided on application Form CMP-4B, the code number 19510 would be filled in, the NPA product listing of Small Arms, Civilian, his own description of his hunting rifle and NPA Division code letters ORD. If he makes several types of rifles and shot guns, he needs to file only one application to cover all his requirements under the small arms listing. This application is sent to the Ordnance Division for processing and approval.

When the manufacturer makes his allotment application for his ball bearing steel requirements the Product Class Code Number will be 35930; the Product, Ball and Roller Bearings and Components; and the NPA Division, GCON (General Components).

A post card is furnished with each Form CMP-4B which is to be filled out properly and attached to the application form when mailed. When the application from the manufacturer has been approved by the NPA Division to which it was sent, this post card will be returned to the manufacturer as a receipt on which is listed the NPA Control Number. Any correspondence or supplementary applications must bear this control number. A receipt post card is given for approved applications.

Although it is not required that a letter accompany the application Form CMP-4B, it is to the best interest of the applicant that a letter go with the application giving a detailed description of the product and how the material applied for will be incorporated in the product.

It has been pointed out how an application for controlled metal can be misinterpreted by an NPA Division. Lamp bases electric, are listed under Lamp Components and are understood by the Consumers Durable Goods Division to mean floor and table lamp bases for

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HYDRAULIC PUMP or MOTOR GEROTER TYPE

Logan Gerotor type. For operating hydraulic systems on trucks, tractors, etc. Delivers 8 GPM at 1200 RPM at 1000 PSI with 5 HP. Can also be used as Hydraulic fluid motor. 3/8" stand pipe ports. ½" splined shaft for pulley or direct attachment. 5½" dia., 7" long. Used but condition guaranteed.

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Special! HYDRAULIC CYLINDER

Gives 20,000 lb. thrust (push or pull) using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lbs. thrust with 3000 PSI. Can also be used on low pressure air systems. 4" bore; 18" stroke; 30½" length. Ideal for road – farm – shop machinery.

29.95

P-3 STRATO POWER PUMP

With built-in variable flow control valve instead. Positive displacement piston type. Displacement capacity: 2 gal. per min. at 1500 RPM at 1250 PSI. Pressure limit 1250 PSI continuous. 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent max. 4500 RPM. Rotates either direction without adjustment . .

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No. 3 HYDRAULIC CYLINDER

Double action. Bore is 1" – Shaft ½". Has stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs.

5.75

P-4 VICKERS ANGLE PUMP

Positive displacement type, angle piston. Displaces .507 cu. in. per revolution. Has capacity of 6 gal. per min. at 3000 RPM at 1500 PSI., continuous, 1875 for 15 sec. Operating speed of 3750 RPM, intermittent maximum, 4500 RPM. Rotates to the right only.

19.49

V-28 4 WAY VALVE

Poppet type. Valve shuts off at neutral position. Has 3/8" AC tube parts . . . 9/16 – 20 thread. Will stand 1500 PSI.

6.75

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which no allotments of metal will be authorized. However, lamp bases in the incandescent lamp industry mean the brass screw base attached to the glass bulb. Therefore, it can be seen that a letter describing the product in which the metal is to be used would facilitate the processing of the application.

Die Sets, Dies, Fixtures, Jigs, Punches, Subpresses and Special Tools are listed under code number 35431, NPA Division GIEQ (General Industrial Equipment). Under the Controlled Materials Plan, all tool, die and machine manufacturers are required to file a set of four CMP-4B forms (original and three copies), unless their total requirements of any one of the materials shown below do not exceed the following amounts for the third quarter:

Carbon Steel	5 tons
Alloy Steel	½ ton
Stainless Steel	None
Copper and Copper-base Alloy	500 pounds
Aluminum	500 pounds

CMP in Operation

As an example of CMP in operation, here are the major steps that would be taken in a military tank program:

1. The Department of Defense needs a large quantity of a certain type tank, and negotiates a contract for its production with Company X.

2. Company X, the prime contractor (or "prime consumer" under CMP definition), determines a production schedule and the requirements for controlled materials. Company X then gets the controlled materials requirements from its suppliers of "A" products ("B" product suppliers do not figure in this CMP compilation).

3. Company X totals up the combined requirements for the contract—both as to quantities and delivery schedules—and presents the whole picture to the procuring claimant agency.

4. The Department of Defense (the claimant agency in this case) adds the requirements for this tank contract to its other programs and presents a total claim for controlled materials to the Program Bureau.

5. The Program Bureau of DPA examines this claim, along with those of other claimant agencies, weighs the combined total against the supply of controlled materials for the period ahead, and then authorizes a program and allots controlled materials to each claimant. (If combined claims exceed supply or cut too deeply into the civilian reservoir of CMP metals, claims may be cut back.)

6. The Department of Defense, now having a total allotment of controlled materials, breaks this allotment down among its many programs according to its determination of relative importance.

7. For the tank contract in question, the Department of Defense then gives Company X an authorized production schedule, an allotment of controlled materials and an allotment number, and also issues a DO rating for the procurement of "B" components and other materials (rubber, tin, etc.).

8. Then Company X (the prime consumer) passes along the allotment and the DO rating to its suppliers of "A" components so they can obtain needed controlled materials and "B" products to meet production schedules. If Company X also happens to manufacture a "B" component of the tank in its own plant, it makes a separate application for an allotment of controlled materials to the appropriate NPA Industry Division.

While these operating steps under CMP place an extra burden above the normal flow of customer-supplier negotiations, the resulting advantages clearly outweigh the inconvenience. Government can be sure that total production planned for any period is in line with the supply of materials, and can guarantee that the materials will be available. And industry can be sure that all components of a complicated product will be produced and delivered in the quantities and at the time they are needed to turn out a finished product.

The basic provisions and requirements of the Controlled Materials Plan will be covered in seven regulations. Their scope and purpose are outlined as follows:

CMP Regulation 1. The purpose of this regulation is to define rights and obligations under the Controlled Materials Plan. It explains how production schedules are authorized for manufacturing operations and how materials are ob-

(continued on page 114)

. . . Plastics, from page 107

ably faster than diamond blade or carbide tooth blade cutting and the cost of blade maintenance is appreciably lower.

4. Rigid work support and saw mounting are essential with an abrasive wheel to avoid hazardous and expensive blade breakage. Adequate safety hood must be provided.

5. Diamond edged stainless steel blade is best where the above conditions cannot be met.

6. Carbide-tipped saws will work satisfactorily where cutting must be done dry.

7. Sawing speeds are equivalent to those obtained on phenolic laminates, much higher than for metal.

8. Carbide dry cutting blade life will be about ½ that found on phenolics.

9. Blade maintenance cost with abrasive cutting is insignificant.

Band Saw Cutting

1. Smooth, accurate edges and fast cutting can be obtained at super high blade speeds (5-10,000 ft./min.) in equipment such as DoALL Zephyr.

2. Satisfactory edges requiring only light benching operations can be obtained at ordinary saw speeds.

3. Extra low blade speeds (300-400 ft./min.) are recommended for longer blade life with standard machines.

4. Standard coarse tooth metal cutting blades are satisfactory. Wavy or raker tooth recommended.

5. Blade teeth will lose initial keen edge in first few inches of cut (no longer useful for metal cutting) but will continue satisfactory for glass laminate cutting for an hour or more of operation on normal thickness.

6. Dust should be removed with vacuum pick-up for production operations.

Milling and Lathe Operations

1. Clean, smooth, accurate surfaces can be obtained at rapid speeds.

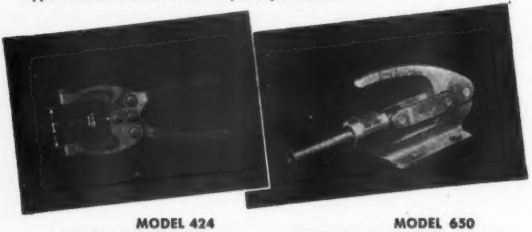
2. Speeds and feeds as for brass will be found most satisfactory.

3. Tools must be kept sharp to avoid

If you have to HOLD

ANYTHING in your production operations

Hold EVERYTHING with "DE-STA-CO" Toggle Clamps in welding, riveting, bonding, machining and assembly. • Fast clamping, positive holding pressures, instantaneous release—Toggle Clamps speed up your operations and cut your costs. • There are more than 40 different Toggle Clamps manufactured by Detroit Stamping Company in various types and sizes to meet industry's requirements.



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HEAVY DUTY PLUNGER CLAMP
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MODEL 235-U RETRACTABLE CLAMP (Not illustrated)
Quick, unimpeded loading and unloading of fixtures easily possible with this one. Up to 750 lbs. pressure.

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crowding pressure against cutter with resultant inaccuracies and tendency to delaminate where cutting edge rises across laminations.

4. High clearance and negative rake should be used on cutting tools.

5. Carbide or diamond tools will give much better life than high speed steel.

Routing

1. For production edging, routing offers higher speeds and lower tool maintenance than any other process.

2. For medium run cutting or irregular holes, routing is much faster and more accurate than jig or key hole sawing.

3. Properly set up for edging operations, routing will give clean, accurate surfaces.

4. Routing of large holes tends to leave a fuzzy edge requiring bench filing.

5. Routing almost has to be done dry and produces profuse quantities of dust which must be removed with vacuum dust collectors.

Dust Control

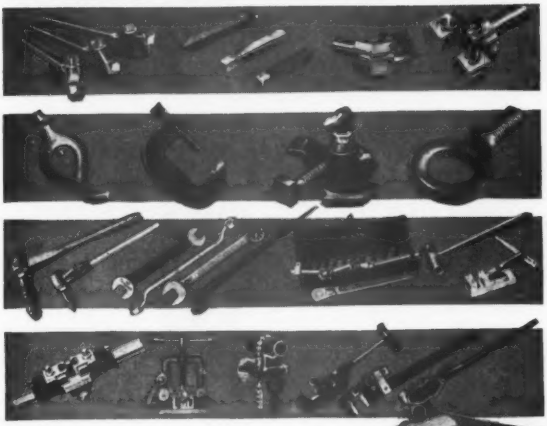
Dry machining operations on Fiberglas laminates produce a fine powder or dust which will cause some unpleasant skin irritation upon first exposure. Operators working with this material regularly will quickly become immune to this annoyance, however. Occasionally, if proper cleanliness is disregarded over an extended period, a skin rash may occur. This is in no sense of a permanent nature. and is invariably due to failure to bathe completely and regularly, or failure to wear clean clothes daily. It is quickly corrected and easily avoided when proper rules of cleanliness are observed. When production operations are equipped with suitable means of dust control removal, this matter is not a problem, and many operations such as blanking and shearing require no dust removal devices.

Cementing

1. Lap joints of modest shear strength

(continued on page 156)

ARMSTRONG



Every tool shown represents a full line of quality tools, known the world over as the finest of its type.

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5220 W. ARMSTRONG AVE., CHICAGO 30, U.S.A.

NEW YORK SAN FRANCISCO

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

. . . Automation, from page 54

(5) Safer operations in many cases.

We have discussed the disadvantages to point out that there are some problems in the development of automation. It is important to realize what to look for in analyzing any problem.

It is our honest belief that the items listed as disadvantages are gradually being solved and that the advantages in proper installations far outweigh them. It is well to again stress the need for simplicity of design and allowance of sufficient time to design a system properly.

The future of automation is tied in with the future of our manufacturing industries in the never ending battle to reduce costs, increase consumption, outsell our competitor.

The future of automation at the Ford Motor Company is assured based on our experiences so far. It is being studied in all of our programs. The future looks promising. The entire program is one which no industry can afford not to be conscious of.

. . . Controlled Materials, from page 111

tained to complete such production schedules.

CMP Regulation 2. Inventories. This regulation forbids the accumulation of excessive inventories of controlled materials. It does this by limiting the quantities of such materials that can be ordered, received or delivered.

CMP Regulation 3. Preference status of delivery orders. The purpose of this regulation is to define, under the CMP, the preferences status of delivery orders for controlled materials and delivery orders for products and materials other than controlled materials.

CMP Regulation 4. Deliveries of controlled materials by distributors. This regulation describes how distributors make deliveries of controlled materials under the CMP.

CMP Regulation 5. Maintenance, repair and operating supplies. This regulation explains how controlled materials are obtained for MRO and minor capital additions.

CMP Regulation 6. Construction. The purpose of this regulation is to explain how to get materials for construction under the Controlled Materials Plan.

CMP Regulation 7. CMP materials for repairmen. In this regulation, the rules under which a repairman may buy controlled materials, and products and materials other than controlled materials, are explained.

CMP Regulations 1, 2, 3 and 4 have been prepared and are available at all regional and field offices of the U. S. Department of Commerce. Regulations 5, 6 and 7 are being prepared and will be available in the near future.

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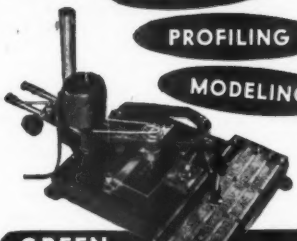

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SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Carboloy Becomes Department of General Electric

Announcement that Carboloy Company, Inc., Detroit, has become the Carboloy Department of General Electric Company, effective June 30th, is far broader significance that at first appears, according to K. R. Beardslee.

Mr. Beardslee, who has been president of Carboloy Company and will continue as general manager of the new G. E. department, revealed that the corporate shift is in line with a vast potential expansion of the activities, capacities and products of the Carboloy organization.

"Although to all practical purposes, the change does not affect our suppliers, district offices or distributors, or our present marketing and purchasing procedures, it will materially facilitate expansion of over-all Carboloy Dept. activities," Mr. Beardslee said.

"We—and industry generally—are entering a new phase of our technical history. This age of metals has taken a new trend—a trend toward the creation of many kinds of new man-made metals. Such metals, the work of human science rather than nature, will probably not replace steels, bronzes, aluminum or magnesium and their alloys. Rather, these new metals will permit us to create things, make things and do things we have not had and could not do before.

"Already industry is making good use of several man-created metals such as carbides, permanent magnet metals, and radiation - resistant 'Hevimet.' . . . Important as these metals are in each of their own fields, they are probably only a foreshadowing of what we believe is still to come.

. . . "Few of us, back in 1928 when Carboloy Company was founded, dreamed of what lay ahead — that we were actually launching what today amounts to a metallurgical revolution. In this broadening the scope of our activities, we are certainly going to need all the scientific and technical help we can get to speed development. The decision to make Carboloy Company a Department of General Electric is therefore a happy one for us.

"It will also be of help in our current expansion of manufacturing activities relating to carbide tools, dies and other products."

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See why at your "K-O" distributor . . . or write for descriptive literature

K. O. LEE CO.
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Cast Alloy Data Folder

Data of value to designers, engineers and other production executives currently confronted with metals conservation problems along with engineering considerations are being made available by Alloy Casting Institute.

Serving as a guide to standard designations and chemical composition ranges for heat and corrosion resistance castings, the chart lists 27 cast alloy types recognized by the alloy casting industry as standard grades for service in extremes of temperature and highly corrosive conditions. This list provides a selection of proved compositions when present critical alloy shortages require choosing a substitute for grades previously employed.

A timely innovation in this folder is the inclusion of a column of wrought alloy type numbers so that the corresponding cast alloy grades may be readily determined, enabling proper use of cast alloy symbols for proper identification of specific casting requirements.

Copies of the folder, "ACI Standard Designations and Chemical Composition Ranges for Heat and Corrosion Resistant Castings," can be obtained without cost by addressing your requests to the Alloy Casting Institute, 32 Third Avenue, Mineola, New York.

★ ★ ★

Enameling Furnaces for Defense Work

Prompted by growing evidence that the demand for new industrial furnaces needed for heat treatment of aluminum and steel defense items is moving beyond the capacity of the producers of such equipment, the Government Business Committee of the Porcelain Enamel Institute has compiled a report of defense work possibilities for porcelain enameling furnaces.

The report states that there are approximately 350 batch type and 250 continuous monorail type enameling furnaces in the U. S. A. All enameling plants also have pickling facilities.

According to the Committee, batch type furnaces could be used for annealing and hardening of various steel products with a minimum of furnace changes. It estimates that utilizing only half the furnaces in the porcelain enamel industry for heat treating would result in a daily output of approximately 36,000,000 pounds.

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STRAIGHT EDGES: Scientifically shaped and ribbed to retain accuracy. Made of special analysis semi-steel.

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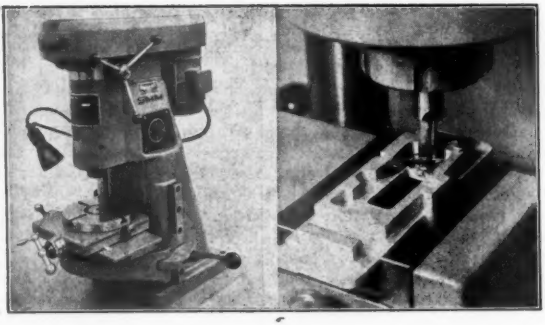

Fig. 1. Left: The Swisma milling machine is a Swiss precision machine for fast and economical vertical milling work and can be used for many other jobs. Without templates the machine will produce multi-sided holes with flat, concave or convex surfaces. Right: Illustration shows a die set up on a Swisma milling machine. The inside and outside contours are multi-shaped, all of which are cut in one setting. The machine is so versatile that it makes possible the simplification of product design.

Milling Multi-Sided Holes

Fast and economical milling of multi-sided holes without the use of templates is performed by the Swisma milling machine, Figure 1, left. The sides of the holes can be flat, concave or convex surfaces, as required. Corners are milled to a radius of one-tenth the distance across the flats but sharp corners can be obtained, if desired, by a second operation using a "K" drill.

In Figure 2, left, is shown a hex hole drilled with a five-lip drill and in the center is shown a three-lip cutter drilling a square hole. The number of lips on a cutter is always one less than the number of sides required in the hole.

In drilling the square hole a three-lip cutter is fed into a round hole previously drilled or bored in the workpiece. While the drill is rotated about its own axis by a gear, an eccentric motion is imparted to the tool. The solid circle shown in the center figure indicates the rotation of the drill, while the dotted circle indicates the eccentric motion imparted to the drill. By relation of the cutting edges with respect to the eccenter, they are constrained to sweep a square, except that the corners have a radius. Permissible drilling depths equal at least twice the width of a flat. In this application of eccenter milling, blind holes with truly square sides and parallel walls are economically obtained.

Ordinary hexagon holes in recessed-head screws are subject to wear by loose-fitting wrenches. This drawback can be overcome with the "J" drill, which produces the inbus hole in special recessed-head screws, spindles, etc. As shown at the right in Figure 2, the inbus hole has concave sides and rounded corners. When a regular Allen wrench is used, the flats on the tool rest upon a considerably extended area and do not indent or wear the sides of the inbus hole.

A rigidly supported cross-fed attachment for the Swisma milling machine allows all sorts of vertical milling work to be done with the highest precision at high speed. Convenience in setting workpieces at various shapes and sizes is afforded by the swing-out table. A central hole in the table accommodates long pieces like special screws, spindles and punches.

Fig. 2. Left: Hexagon shaped hole is cut with a five-fluted drill while the square hole, center, is cut with a three-fluted drill. The solid circle indicates the rotation of the drill around its own axis, while the dotted circle indicates the eccentric motion imparted to the drill. At right is shown hex hole with concave sides used on special socket head screws.

Photos courtesy Gubelin International Corp.

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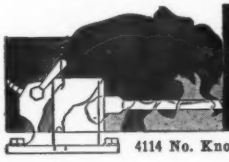

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SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Circle postage-free Inform-A-Gram Key Number for your request.

End Mill Technical Data are included in Pratt & Whitney's new Circular No. 534. A section deals with end mill terminology, gives tips for better end milling, and contains useful reference material on cutting speeds, feeds, coolants, sharpening, opening centers of ball nose mills, relief angles, inspection, etc. This well-illustrated, 60-page booklet also contains complete listings for over 500 types and sizes of P&W End Mills, including a number of new items. Copies can be obtained from PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., West Hartford 1, Conn.
Circle Inform-A-Gram No. C1.

Ingersoll Cutter Grinder Manual No. 58 has just been released. This attractive, 47-page booklet contains an informative section on cutter grinding practice. Here, the essential points in the grinding of inserted blade milling cutters are covered. Other sections fully illustrate and describe the features of the Ingersoll Cutter Grinder, and picture maintenance and repair parts. Send requests for the manual to THE INGERSOLL MILLING MACHINE CO., Douglas & Willoughby Aves., Rockford, Ill.
Circle Inform-A-Gram No. C2.

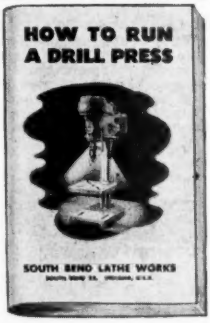
The Proper Care of Punches and Dies is covered in a useful wall chart offered by The Cleveland Punch & Shear Works Co. This 12½" x 19½" chart discusses many of the causes of punch failure, including: incorrect lining up of punch and die; poor positioning of the stripper; loose nuts and stems; and use of the punch for ripping, without a proper punch holder. Address THE CLEVELAND PUNCH & SHEAR WORKS CO., 3917 St. Clair Ave., Cleveland 14, Ohio, for one of these wall charts.
Circle Inform-A-Gram No. C3.

"Plant Protection for National Defense" has been revised by Detex Watchclock Corp. for distribution to those engaged in defense production. This manual is designed to solve plant protection problems by instituting security systems for preventing loss of life, damage to property and sabotage of war material. It covers the training of watching personnel, the planning of hourly routes, etc. DETEX WATCHCLOCK CORP., 76 Varick St., New York 13, N. Y.
Circle Inform-A-Gram No. C4.

"The Eutectic Welder" is an informative external house organ that illustrates and describes case histories of cost-cutting applications of low-temperature welding alloys. To get your name on the mailing list, write to EUTECTIC WELDING ALLOYS CORP., 40-40 172nd St., Flushing, N. Y.
Circle Inform-A-Gram No. C5.

The Phillips Vapor Degreasing Handbook answers most of the questions generally asked about vapor degreasing. Photographs of various types of units along with useful data charts are included in this 21-page booklet. PHILLIPS MFG. CO., 3475 W. Touhy Ave., Chicago 45, Ill.
Circle Inform-A-Gram No. C6.

The New South Bend Drill Press Manual contains 32 pages and more than 75 illustrations. This booklet is devoted exclusively to the small sensitive-type drill press. A section on care, operation and maintenance includes illustrations giving the name and function of all important parts and correct adjustment of each unit. Best methods for mounting and removing chucks and tools are explained. This manual can be secured direct from SOUTH BEND LATHE WORKS, Dept., T&P, South Bend 22, Ind. Price is 25¢ postpaid.



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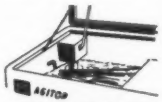
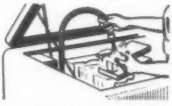


1. Solvent discharged jet-like agitates tank for soak cleaning.

2. Fountain like discharge for large parts.



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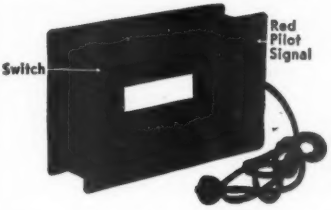

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SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Cutting Costs in Drilling and Tapping

A new model Burgmaster six-spindle automatic indexing, drilling and tapping machine has been developed in order to cut costs by reducing waste motion in production and to make movement of the workpiece from one machine to another obsolete.

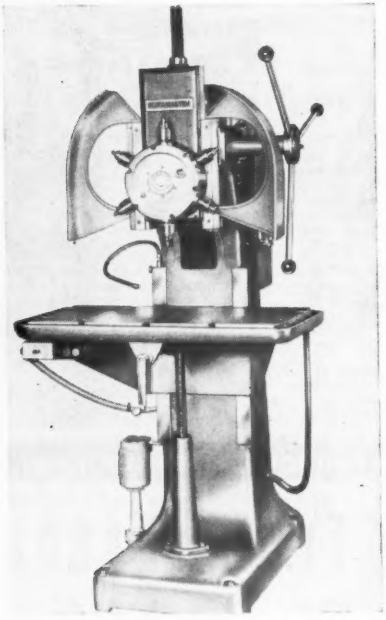

Photo courtesy Burg Tool Mfg. Co.

This precision machine is designed to combine the time-saving features of the turret lathe with the simplicity and universal adaptability of the drill press.

Setup is simple and fast. One machine does the work of five or six; consequently, less power is used and less floor space is needed. Labor cost is reduced, since one man does the work of five or six men. The rigidity, power and accuracy of the machine permit the use of high cutting speeds.

This new machine makes the use of carbide tools for second operations on drill press work practical, since in many cases several operations on a part can be completed without moving the part, thereby eliminating the danger of tool breakage due to the jig being out of position with respect to the tool.

Important new features of this Burgmaster are as follows: power index from one spindle to another with a wide range of spindle speeds, pre-selective per each spindle; pre-selective and automatically indexed, capable of holding very close tolerances on depth; ¾" capacity in steel; heavy-duty tapping head; 8" stroke; extra-heavy, one-piece column; 17" x 33" table work surface; 11¼" throat depth; spindles on tapered, adjustable roller bearings; totally enclosed gearbox, running in oil; and sensitive, yet powerful feed mechanism, which provides "feel" when using small drills, yet gives a powerful leverage that makes large-hole drilling easy.

★ ★ ★

NTDMA Seeks Change in Draft Policy

A revision of draft regulations—with the Government recognizing the importance of training in the tool and die field—is being sought by the Trustees of the National Tool and Die Manufacturers Association so that apprentice training will be considered as important as college work for draft purposes.

Under such conditions, toolroom apprentices would be allowed to complete their technical training before being subject to draft. Such technical training takes 3½ years or about 8000 hours of plant instruction, according to Herbert S. Jahn, president of the NTDMA and spokesman for the group.

The Trustees of the Association have proposed this policy as one solution of the skilled-manpower shortage, which is a difficult problem for an industry as basic to mass production as tool-and-die-work is.

"The Welding of Stainless Steels" has been prepared by The McKay Co. This 48-page handbook describes, in easy-to-follow, question-and-answer form, various types of these steels, practical procedures for their efficient welding, and types of electrodes available for such use. Write for this valuable handbook to THE McKAY CO., Dept. T&P, McKay Bldg., Pittsburgh 22, Pa.

Circle Inform-A-Gram No. C7.

Twenty-Four Pages of typical applications of Leiman Air Pumps make up Bulletin 90150 offered by Leiman Bros., Inc. Each application is clearly illustrated and described. It's a handy reference booklet for users and prospective users of these efficient pumps. Address LEIMAN BROS., INC., P. O. Box 1339, Newark 5, N. J.

Circle Inform-A-Gram No. C8.

"Vanadium Data Sheets" is an 80-page, spiral-bound book containing information, in tabulated form, on 180 different compositions of vanadium iron and steels, including constructional steels, spring steels, tool steels, plate and sheet steels, cast steels and alloyed irons. Chemical compositions, heat treatments, mechanical properties and typical uses are shown. In addition, there is a detailed index of applications and recommended compositions for each. Write on letterhead to VANADIUM CORP. OF AMERICA, 420 Lexington Ave., New York 17, N. Y.

"Heat Treating and Pickling of Armco Stainless Steels." This liberally-illustrated, 36-page booklet gives correct procedures for applying the various heat-treating processes to several types of stainless steel. Sections are devoted to basic techniques; furnaces; preparation for heat treatment; practices for chromium-nickel, ferritic chromium and martensitic chromium types; surface hardening; pickling (scale removal); etc. ARMCO STEEL CORP., Dept. T&P, Middletown, Ohio.

Inform-A-Gram No. C9.

Imaginative Uses of Plastics are contained in a new booklet entitled "Idea Generators," published by the Plastics Div. of Monsanto Chemical Co. This booklet consists of six case histories illustrating plastics' answer to the rut frequently created by conventional, habitual patterns of thinking. MONSANTO CHEMICAL CO., Plastics Div., Dept. T&P, Springfield, Mass.

Circle Inform-A-Gram No. C10.

"Safety Pays the Smaller Business" is an eye-opening booklet pointing out that the smaller businesses of the country suffer the bulk of the loss through industrial accidents, and giving concrete suggestions for handling this difficult problem. For a copy, write NATIONAL SAFETY COUNCIL, 425 N. Michigan Ave., Chicago 11, Ill.

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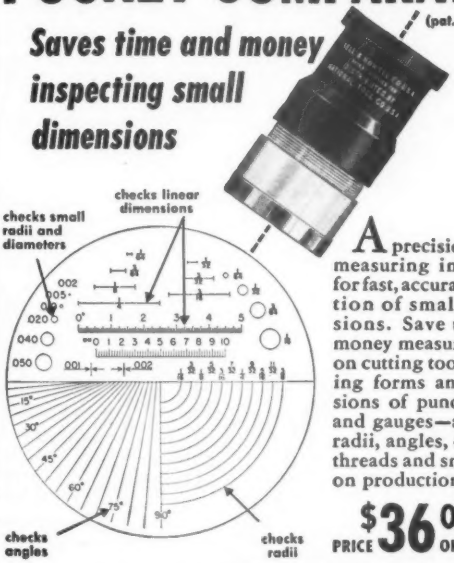

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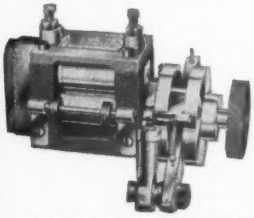

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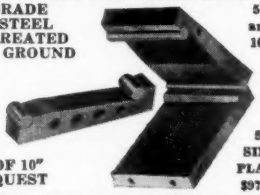

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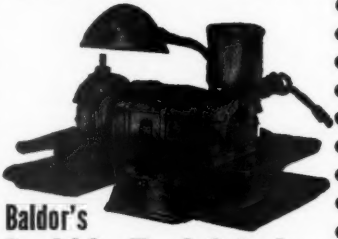

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State-Federal Conference on Defense Production Training

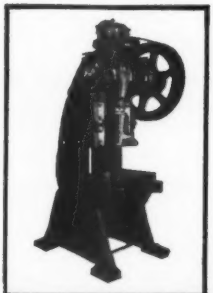
The training job ahead for the defense production industries and what is being done to build up the skilled work force were discussed at length by representatives of State and Territorial apprenticeship agencies, and the U. S. Department of Labor's Bureau of Apprenticeship, at a recent three-day joint conference in Washington.

The meeting was opened with addresses by Secretary of Labor Maurice J. Tobin; Frank P. Graham, Administrator, Defense Manpower Administration; and W. F. Patterson, Director, Bureau of Apprenticeship.

Secretary Tobin compared the labor situation in the present emergency with that during World War II, and stressed the vital part of apprenticeship to provide the craftsmen needed in defense production. "There is not a free country in the world," he said, "which does not look to America for leadership. We are faced today with a tremendous production task; and apprenticeship is going to play a big role in providing the skilled manpower."

Mr. Graham in his address said: "To carry out the defense production program we will need by the end of this year from three to four million more workers. . . . We are now in a tooling up period. We need the training and skills now to relieve the present bottleneck as well as for the long haul. Apprentice training, vocational education—all programs of training within and outside the plants—are essential in the defense program."

Among the topics discussed by conference members were procedures in determining training needs in defense industries, legislation relating to employment and training, and public relations.



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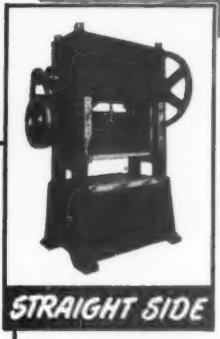

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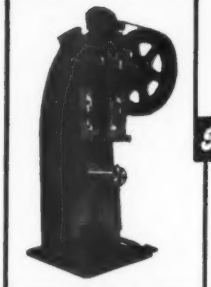

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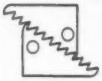

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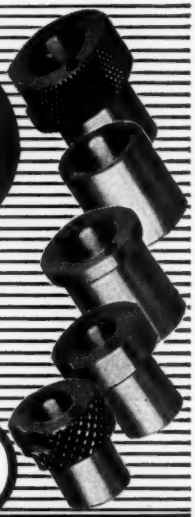

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. . . Production Lapping

the work rotates and reciprocates back and forth under the abrasive cloth in an axial direction.

A machine of this type is shown in Figure 7. This process removes tool and grinding marks and refines the surface to a 15 or better micro inch finish at a very rapid rate even though the initial finish may be as rough as 80 micro-inches.

Another type of machine, the Gisholt Super-Finishing machine, does the same type of work by very rapidly reciprocating the abrasive which is, in this case, a bonded abrasive stone clamped in a holder. This machine has a somewhat broader range of application and can be used to finish external surfaces which are located in recesses in the part as well as internal surfaces.

Both of these types of equipment change the diameter of the part an amount determined by the initial finish condition, and the time they are subject to abrasive action. The process does not generate dimensional accuracy, only surface refinement, so the preceding operation must be carefully controlled in order that final size may be obtained.

Internal "Micromatic" Honing

The internal honing machine is most generally associated with the honing of cylinder bores in automotive engines, however, its use on automatic transmission work is particularly advantageous for the following reasons:

In the manufacture of the small pinion gears in the planetary gear set a very high degree of concentricity is required between the gear teeth and the final internal diameter upon which they rotate on needle bearings. A high finish and accurate control of diameter to a tolerance of .0005 of an inch is also required.

To obtain this the hole is drilled, reamed, precision bored and then "green" honed to a close limit, then the teeth

(continued on page 131)

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Safety Pays the Small Plant

More than two-thirds of all industrial injuries occur in plants with fewer than 100 workers. Thus, it is clear that small plants, directly or indirectly, pay most of the industrial injury costs.

The conclusion that accident prevention is largely a small-plant problem is supported by two facts. First, reports of the Department of Commerce show that the smaller plants employ half the workers. Second, the accident frequency rate (number of disabling injuries per million man-hours worked) in these plants is more than double that of the large plants.

Most large plants learned years ago that there is profit in accident prevention because it reduces operating costs, improves employee relations and earns public good will. Each of these same factors affects the economic welfare of smaller plants as a group and as individual concerns.

Not only do small plants pay most of the estimated 2½ billion dollar annual cost of occupational injuries; small-plant workers and their families suffer most of the consequences of the 16,000 occupational deaths and two million occupational injuries.

Accident costs represent non-productive expense. As they increase, profits decline and the employer is placed at a disadvantage in competitive markets. Two types of costs are involved.

Direct and Indirect Costs

The direct cost of an injury (compensation and medical expense) is readily apparent. The indirect cost is not always recognized, yet it is usually much greater than the direct cost. Some of the indirect costs (all paid by the employer) include: labor and material loss through cancelled orders; time lost by injured employees; time lost by fellow employees; repairs to damaged equipment or tools; unearned wages paid injured employees; time lost by executives; property damage; forfeits—failure to complete job on time; and overhead loss.

Employee Relations

Labor relations is a term too readily identified with big plants only. The problem is real in all plants, large and small. Many employers have found that sincere accident prevention efforts improve employee relations. The results are two-fold:

Morale is improved. Workers who have confidence in their employer's interest in safety are freed from distracting influences. They work more efficiently and are more loyal.

Turnover is reduced. The plant that makes a sincere safety effort becomes "a good place to work." The results of labor turnover are more serious in the small plant than the large one. Training replacements is expensive, and small plants have few trained workers in reserve to replace those lost through injury or dissatisfaction with working conditions.

Accidents Can Be Prevented

Accidents are being prevented. Frequency rates are steadily being reduced, but the reductions are chiefly in the large plants with active safety programs. The gains are offset by continued high accident rates in smaller plants. The annual total of killed and injured thus changes but slightly.

A nine-point program designed to get results has been set up by the National Safety Council. A brief outline of the program follows.

Assign Responsibility. One person should accept responsibility for all details concerning safety and loss prevention.

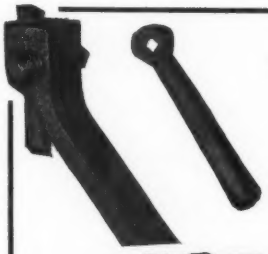
Provide Safe Working Conditions. Secure assistance from the insurance carrier or other qualified agency in making a study of operations. Such a study, to accomplish control over accident exposure and operating losses, must cover the three essential factors in any plant operation: equipment, personnel, materials.

Make Regular Safety Inspections. These will disclose unsafe conditions before they cause injuries.

Give Safety Instructions to Workers. The new worker should be informed that

(continued on page 132)

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION



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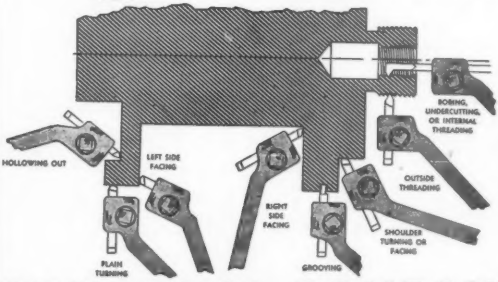

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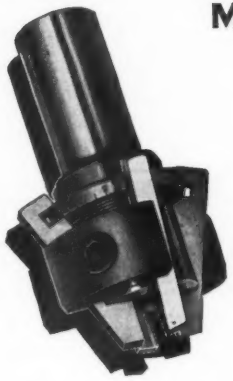

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SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

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Model FS with new All-Purpose, Deep - Throated Overarm performs all tool and die - making operations at low cost.

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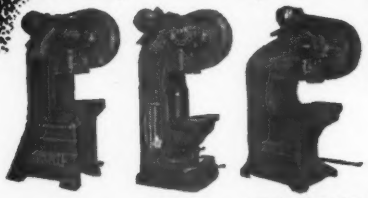

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LOW ANNUAL MAINTENANCE
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. . . Production Lapping, from page 127

are cut and shaved in relation to this hole. After the hardening operation the hole is finish or "hard" honed to final size removing approximately .001 of an inch of stock per side. As this honing operation follows the original honed hole, concentricity is maintained.

The alternate process of grinding the hole has been found undesirable because of difficulty in maintaining accuracy of chucks which of necessity would locate from the pitch line of the gear teeth, as well as being considerably more expensive.

"Micromatic" Honing Machine

This machine, Figure 8, as used for above purposes, is a two spindle automatic machine. The gears are loaded into fixtures mounted on an indexing table. Two fixtures are unloaded and reloaded while the honing operation is being completed on two gears at the working station.

The fixtures are designed with a floating action so that the gear axis conforms to the axis of the honing tools.

A relatively long and narrow bonded abrasive stone is molded into a similarly shaped holder. Three or more such holders are equally spaced about the periphery of the tool in slots so they are free to move in and out in a radial direction controlled by a cone shaped expander which in turn is caused to move in axial direction by a hydraulic or mechanical control system.

In operation the honing tool enters the work, starts to rotate, expands at the bottom of the first axial reciprocation into contact with the hole, continues to rotate and reciprocate while the honing stone, under pressure exerted by the cone, contacts and abrades the part.

This action continues until the hole reaches the low limit of the manufacturing tolerance at which point a "microsize" attachment automatically stops the operation, collapses the hones to the initial condition and withdraws the honing tool.

This machine generates a high degree of dimensional accuracy as well as a fine surface finish by combining the multi-

(continued on page 135)

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With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon–high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

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Also makers of—
BLACK DRILLING UNITS—AUTOMATIC, SELF-CONTAINED—FOR COST-CUTTING PRODUCTION ON ALL MATERIALS
Write for information

. . . Safety, from page 128

safety is an important factor in the company policy and made acquainted with the basic safety precautions he is expected to observe.

Provide Effective First Aid. Good first-aid treatment prevents minor injuries from becoming serious—minimizes the effects of serious injuries.

Keep Records. Infrequent occurrence of serious injuries does not mean there are few accidents. Most accidents cause minor injuries; periodic review of these cases will point to hazardous conditions before serious injuries are caused.

Maintain Interest. Make a neat and conspicuous display of applicable safety posters. Have key personnel attend meetings of safety organizations. Distribute leaflets on job safety to workers.

Guard Against Public Losses. Losses from injury to persons other than employees are potentially serious because there is no limit on the amount of damages that may be claimed.

Promote Off-the-Job Safety. Off-the-job safety promotion may help in promoting safe work habits on the job, in addition to preventing loss of skilled workers through off-the-job accidents.

Who Can Help

There are several sources from which the small plant can obtain aid in initiating a safety program. The insurance carrier is the most convenient source of assistance in the prevention of losses. Both federal and state labor departments will furnish information and provide assistance on safety problems. Many business associations promote important safety activities. Finally, the nation's leading source of safety information, the National Safety Council, can supply valuable aid to the small plant for its program. Staffed with technicians in all fields of safety, it gathers and publishes accident statistics and mass-produces safety training materials and program aids for safety engineers and supervisors.

FOR DETAIL MARKING OF NAME PLATES CAN BE USED ON WOOD, PLASTICS, ETC.

Now there is a new labor-saving device — one that will really save many dollars. It's the AUTOMARK Electric Metal Marking Typewriter. Its uses are almost limitless where metal marking, once a slow tedious operation, can now be accomplished in one-fifth the time formerly required. The AUTOMARK has been perfected for the detail marking of name plates — no levers to pull — no dials to spin—it's all-electric, with automatic table feed. It actually will reduce the cost of production dollars five times by its speed. Strong enough to mark on steel up to ½" thick, yet can be adjusted to mark on wood or plastics. Simple to operate, it has a letter wheel made from high grade alloy tool steel. Type sizes interchangeable—1/32" to ¼" — any size wheel can be inserted quickly, easily.

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1 Commander TAPPER

The Commander Tapper's exclusive torque control thinks for its operator—automatically stops when taps are dull, overloaded or strike bottom in blind hole tapping.

You get maximum tap protection because the torque control can be set to protect all taps in the range from No. 0 to 3/4". Spring clutch drive eliminates slippage and wear—provides smooth, quiet, easy operation.

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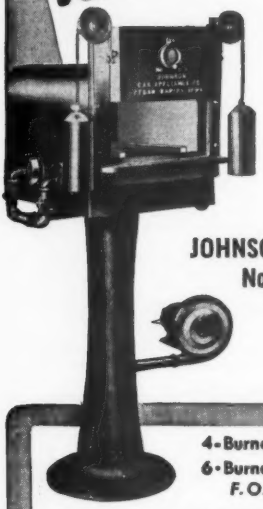

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BRIGHTON
Screw & Mfg. Co.

. . . Production Lapping, from page 131

plicity of motions, low cutting speeds, and low unit pressure as previously indicated for flat surfaces while still retaining the desirable feature of high productive rate.

The cost of operation of all of these machines, classed here under the general heading of "Lapping Machines," are made up of two factors as follows:

1. Direct Labor. The production per operator on all four types is high enough to justify their use in mass production type industry and is quite comparable with other conventional types of machines.

2. Material required to maintain the operation is a major factor. With the "Lapmaster" it consists of abrasive, cutting fluid, and periodic replacement of lap plate, conditioning rings, and work holders. The "Hyprolap" requires cutting fluid, and periodic replacement of bonded abrasive wheels, diamonds required to true the wheel, and, to a lesser extent, work holders. The remaining types require abrasive cloth, bonded abrasive stones, and the necessary holders as well as cutting fluid.

Cost comparisons are somewhat incomplete at the present time due to the recent development of the "Power-Glide" automatic transmission, but the general indication is, as might be expected, that it is the function of the amount of material being removed (area being lapped X depth of stock removed) rather than the design or type of machine.

Conclusion

In conclusion it appears that the present day demand by the people who buy the products of the automotive industry for more automatic and higher quality mechanical devices will force the tool engineer to give more consideration to processes such as have just been described. The rate of production to be expected from this process has now developed to a point necessary to justify its classification as a tool for mass production and its major disadvantage of high cost of material to maintain the process will undoubtedly respond to further development effort.

This is it!

This cross-section tells it's own story of how to save money on production drilling

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MEYCO bushings combine the best features of steel and carbide . . . the protection of steel with the long life of carbide at the points of wear. First cost: higher; end result: substantial savings in production costs. Made to ASA standards . . . MEYCO bushings will SAVE you money. Don't miss *this* bet! Many sizes now available from stock.

User Says:

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To help alleviate the situation caused by shortages of vital materials and parts, and because of the great demand for precision bearing centers, Ready Tool Company, Bridgeport, Conn., has opened a Repair Service Department.

Defense orders expect accurate tolerances, a speed-up of production and strict adherence to specifications. Many plants are finding they cannot qualify because the centers being used on their machines are no longer accurate. They are old, worn and badly in need of reconditioning. New ones are not coming as fast as they would like them.

This new department will accept all RED-E Anti-Friction Bearing Centers for repair, regardless of age or condition. Each center is reground to its original accuracy, regreased for life and the bearings replaced with No. 5 A.B.C.E. specification bearings. They will be fully guaranteed. Centers beyond repair will have a trade-in value.

Ready Tool engineers advise against mechanics taking the centers apart for repair. Unless you have the right tools, parts and bearings, you can never make the center perfect. The factory has these tools and parts and can do the job properly.

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★ ★ ★

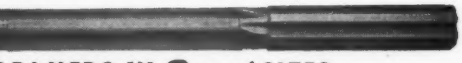
SELLING TERMS ANALYSIS

For the past year and one-half the Pressed Metal Institute has been analyzing selling terms used by many companies in the stamping industry towards the end of offering standardized selling terms, provided concurrence could be reached with the National Association of Purchasing Agents.

This approval has now been secured and "Terms and Conditions of Sale for the Pressed Metal Fabricating Industry" has been released to the industry.

A few copies are available without charge from the Pressed Metal Institute, 13210 Shaker Square, Cleveland 20, Ohio. Quantity orders should be forwarded and will be priced upon request.

SUPEREAM



REAMERS IN *Decimal* SIZES

From .032 all the way up—Blanks can be ground to your exacting specifications and delivered in approximately 10 days. By purchasing SUPEREAM REAMERS in steps of .001 you SAVE—Time, Labor and Money in the cost of extra machining and lapping. SUPEREAM REAMERS all have ground and polished flutes and are held within .0002 tolerance. REAMERS are also furnished in Right-hand spiral, right-hand cut, as well as Left-hand spiral, right-hand cut.

Write for descriptive literature and prices.

IN EMERGENCY PHONE INDEPENDENCE 3-9180

TWENTIETH CENTURY MANUFACTURING CO.

3720 MONTROSE AVENUE CHICAGO 18, ILLINOIS

"THE ORIGINAL" MAUSER

MAUSER PRECISION VERNIER CALIPER

$14.75 PPD

MONEY BACK GUARANTEE FOR MEASURING INSIDE, OUTSIDE, AND DEPTH. 3 GRADUATIONS 1/1000" — 1/128" 1/10 mm. IN BACK

NEW EXCLUSIVE CAMLOCK AND GIB IMPROVEMENT INSTANTLY FIXES SETTING, PREVENTS SHIFTING, GUARANTEES SQUARENESS OF JAWS.

THE MAUSER TRADEMARK... IS YOUR PROTECTION.

GEO. SCHERR CO. INC. 280-T LAFAYETTE ST. • N.Y. 12, N.Y.

YOST DRILL PRESS VISE

● **This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.**

OFFERED IN TWO SIZES

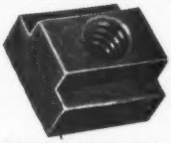
Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	4	12½
2D	5	5½	23

Do you need a vise of ANY type?

Write today for bulletin on the extensive Yost line

YOST MFG. COMPANY
1000 MAIN STREET
MEADVILLE • PENNSYLVANIA

SEND FOR FREE CATALOG TODAY

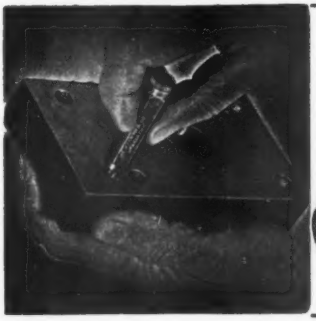


T-NUT & STUD SETS
STEP BLOCK SETS
PUNCH PRESS SETS

QUARTER TURN SCREWS
SHOULDER SCREWS
DOUBLE END JIG FEET
SCREW TYPE JIG FEET
PRESS TYPE JIG FEET
FLANGED NUTS
CUT THREAD STUDS
TEE-NUTS
COUPLING NUTS
ADJUSTABLE STEP BLOCKS
STAR TYPE HAND KNOBS
HEXAGON TYPE HAND KNOBS
KNURLED HEAD SCREWS

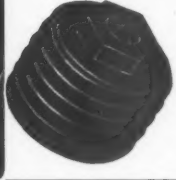
Northwestern

116 HOLLIER AVE., DAYTON 3, OHIO



A REAL HELPING HAND

It's a help that die makers, tool makers, machinery builders and general machinists have long sought—a more accurate and surprisingly faster way of transferring screw holes.



The Heimann Transfer Screw Set is a self-contained, complete tool. No wrenches or pliers are necessary. Made in $\frac{1}{16}$" to 1" diameters.

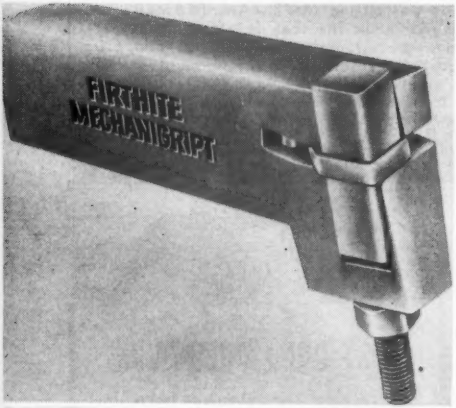
Send for price list.

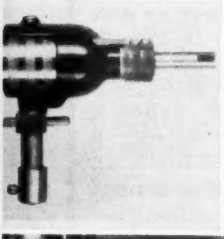
HEIMANN MFG. CO.
Dept. T Urbana, Ohio

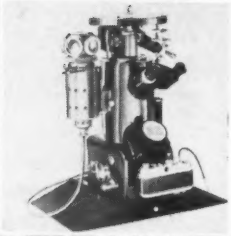
SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

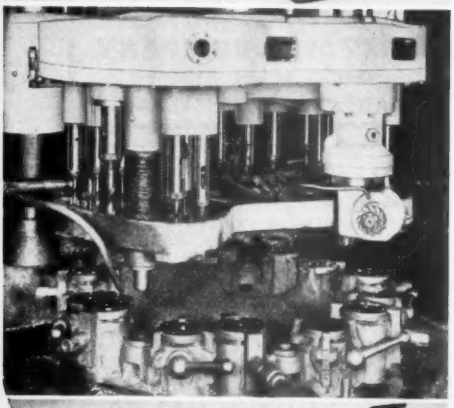
PROGRESS

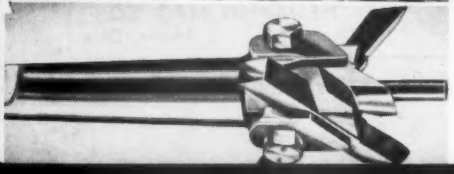
NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS











The Carbide-Insert Mechanigript Tool Line of Firth Sterling has been re-designed in order to eliminate chip erosion of the tool shank. The new tools feature open facing of the carbide insert so that the chips curl against the carbide. Another new feature is top or bottom screw adjustment of the insert. Write for complete details to FIRTH STERLING STEEL & CARBIDE CORP., Dept. T&P, McKeesport, Pa.
Circle Inform-A-Gram No. A1.

A Portable Tool and Die Filer (outside cut), made in Sweden, is now available from Nord International Corp. Carbide and other hard-metal tools can be sharpened by the motor-driven "Di-Profile" without removal from their work place. An adjustable stroke gives high efficiency and also makes it possible to work in shallow holes. NORD INTERNATIONAL CORP., 50 Church St., New York 7, N. Y.
Circle Inform-A-Gram No. A2.

The Griswold OPL Metallograph (inside cut) makes possible a rapid, low-cost method of structural analysis of metal samples with speed, accuracy and thoroughness. A large assortment of objective, ocular and projective lenses is provided. The compact OPL Metallograph occupies a table space of less than 12" x 12". Controls permit fast, positive manipulation of all variables. F. T. GRISWOLD MFG. CO., Dept. T&P, Wayne, Pa.
Circle Inform-A-Gram No. A3.

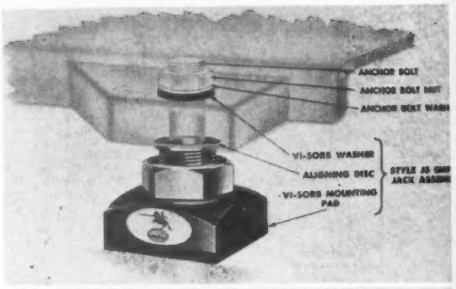
A Full Ball Bearing 34-Spindle Drillhead with suspended bushing plate and oil circulating pump has been made by Thriftmaster for machining compressor parts at Norge. Parts are held in an 8-station rotary indexing table while they are drilled, reamed, countersunk, trepaned and milled. A completed part is ejected with each stroke of the drill press spindle. THRIFTMASTER PRODUCTS CORP., 1062 N. Plum St., Lancaster, Pa., will furnish details on their complete line of standard and special drillheads.
Circle Inform-A-Gram No. A4.

The Clark 3-Blade Adjustable Hole Cutter performs the cutting of accurate, finished holes in a single operation. It features replaceable cutter blades that are easy to sharpen and set. The body of the tool is made of heat-treated steel with three HSS blades set 120° apart. Pilots are removable to allow the use of lead drills. ROBERT H. CLARK CO., 9330 Santa Monica Blvd., Beverly Hills, Calif.
Circle Inform-A-Gram No. A5.

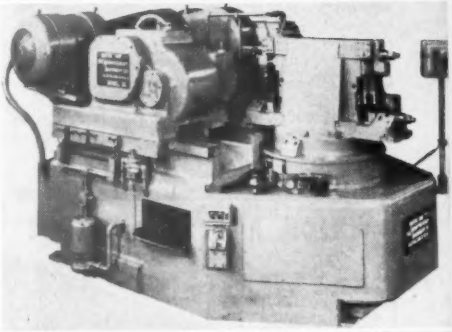
ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

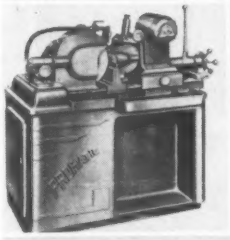
Style "JS" Empco Jack will support 20 tons and lift 8000 lbs. without over-exertion on the wrench. It raises or lowers by simply turning the adjusting nut to right or left. An anchor bolt hole through the jack assembly allows clearance for ¾" diameter bolt, making it possible for this jack to be located at the point where it is best supported. ENTERPRISE MACHINE PARTS CORP., 2735 Jerome Ave., Detroit 12, Mich.
Circle Inform-A-Gram No. A6.



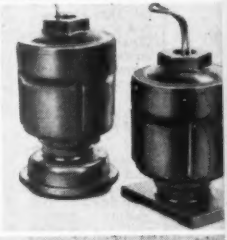
A Duplex Milling Two-Station Machine for face milling is announced by Motch & Merryweather. The work illustrated is machining of tractor side bars mounted two in each station. Production is rated at 268 pieces per hour, using carbide-tipped cutters. The heavy-duty milling heads can utilize up to 30 hp and have 2" of quill adjustment for cutter wear. The cycle of operation is automatic. THE MOTCH & MERRYWEATHER MACHINERY CO., 715 Penton Bldg., Cleveland 13, Ohio.
Circle Inform-A-Gram No. A7.



Promatic No. 1 Centerless Grinding Machine (inside cut) has a capacity of 1¼" maximum stock diameter. Regulating wheel has infinitely variable speed of from 35 to 350 rpm. Micrometer dial is graduated in .0001" for accurate setting of regulating wheel. Both wheels are contour-dressed from a single template. For details write DIVERSIFIED METAL PRODUCTS CO., 5125 Alcoa Ave., Los Angeles 58, Calif.
Circle Inform-A-Gram No. A8.

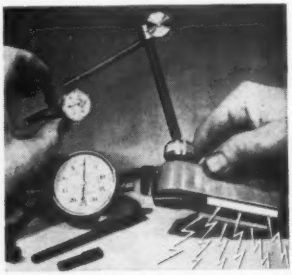


A New Explosion-Proof Solenoid Housing (outside cut) is for use on Ross electrically operated, pilot controlled valves. The cover, which can be used wherever fire and explosion hazards exist, is made of cast-aluminum to Underwriters' Laboratory specifications, Class I, Group D, Air Break Type. Provision is made for standard conduit connection. ROSS OPERATING VALVE CO., 120 E. Golden Gate, Detroit 3, Mich.
Circle Inform-A-Gram No. A9.



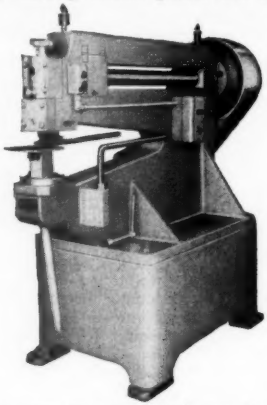
The AccrAngle Grinder Attachment permits the grinding of cutting tools, threading tools, box tools, or any single-point tool, any angle of rake or clearance, without removing tool from holder. It holds any tool up to ½" and is adaptable to all surface and cutter grinders. Available literature gives full details on this precision instrument. CARL NOMANN CO., 3537 Greenwood Ave., Los Angeles 22, Calif.
Circle Inform-A-Gram No. A10.

No. 150 Duplex Magnetic Indicator Holder of Enco Mfg. Co. attaches with a 100 lb. pull to flat or curved surfaces, for holding securely all dial indicators precisionally in place. The unit is equipped with a fingertip



release for removing or positioning the holder without jarring the indicator being held. Details are obtainable from ENCO MFG. CO., 4522 W. Fullerton Ave., Chicago 39. Ill.
Circle Inform-A-Gram No. A11.

Model 430 Campbell Nibbling Machine is one of a new line that cuts odd shapes of ferrous and non-ferrous metals quickly and cleanly. The work can be fed equally well in any direction because the work is cut with a rapidly moving circular punch that operates



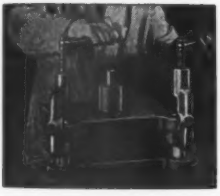
over a circular die. CAMPBELL MACHINE DIV., American Chain & Cable Co., Inc., Bridgeport 2, Conn., will mail a descriptive brochure.
Circle Inform-A-Gram No. A12.

WHICH ARE YOU USING?

. . . the grunt-pull, hammer-wrecking bar, costly method of die separation . . . using two or three men? Results are pinched fingers, scored pins, battered dies and waste of time and money.

OR

. . . the modern efficient method that is now in actual use by hundreds of leading plants and die shops* —The Acro Die Set Puller method. Write for free information. Ask for bulletin TD 1250.



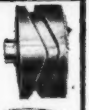
*List of users on request.

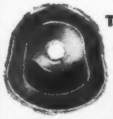
ACRO METAL STAMPING CO.
330 E. RESERVOIR AVE.
MILWAUKEE 12, WIS.

DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Penna.

EISLER JIG BORING **CAM MILLING**

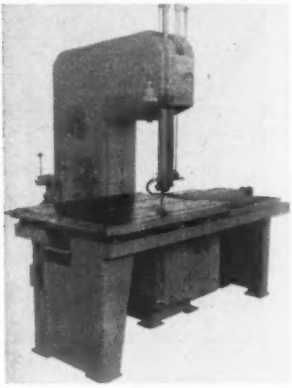
A SPECIALIZED ROWBOTTOM CAM MILLING SERVICE . . . JIG BORING . . . SPOT WELDING . . . CONTRACT PRODUCTION . . . EXPERIMENTAL DEVELOPMENT





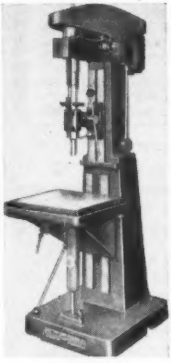
EISLER ENGINEERING CO., INC.
732 S. 13th Street (Avon Ave.)
Newark, N. J.

The New DoAll Contour-matic shown below is equipped with a 36" stroke, heavy-duty, hydraulic work table. This special-purpose work table enables the Contour-matic band machine to handle such heavy jobs as the precision machining of heat resisting alloy



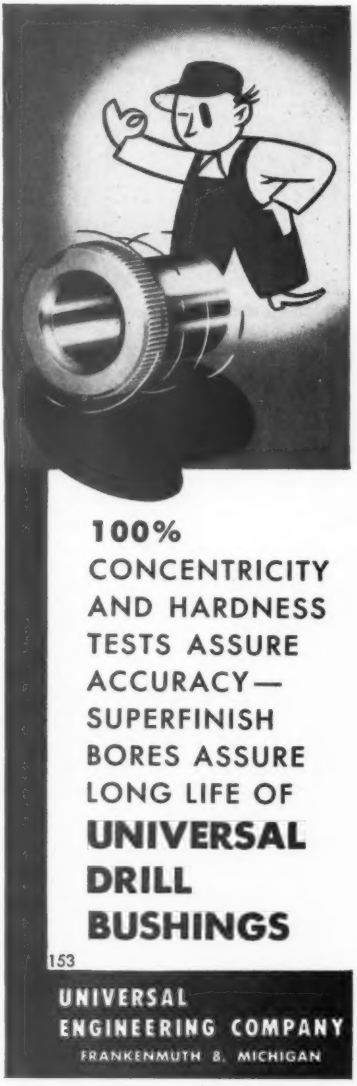
components in jet engine production. The large capacity table is used for fast, straight, accurate, perpendicular power fed band sawing, slotting and grinding to close tolerance. Details on the operating and design features of the Contour-matic may be had from THE DoAll Co., Dept. T&P, Des Plaines, Ill.

Circle Inform-A-Gram No. A13.



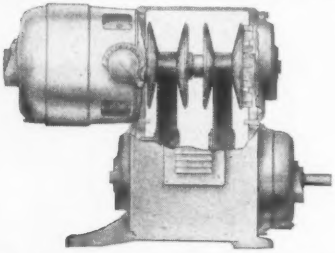
Drilling Machine Line. Purchase by The Ohio Electric Mfg. Co. of all tools, patents and rights to manufacture the Taylor & Fenn line of drilling machines was recently announced. These machines are made in two models: No. M-125 (pictured) is powered by a ½ hp Ohio ac motor which gives a drilling capacity of ⅜" in mild steel; and No. M-96 driven by a ¾ hp Ohio ac motor for drilling holes up to ⅞" diameter in cast iron. Both models are furnished in bench or floor types with one, two, three, four, five or six spindles. Dimensions, weights, etc., are available from THE OHIO ELECTRIC MFG. CO., 5900 Maurice Ave., Cleveland, Ohio.

Circle Inform-A-Gram No. A14.



SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

Extra Heavy Duty Dual Belt Variable Speed Motors with ratings as high as 50 hp have been developed by U. S. Electrical Motors, Inc. Dual Varibelts have been incorporated to



carry the heavy load through the internal speed changing transmission, thus distributing the load so that no undue strain is imposed. To counterbalance belt load, tension control known as Autotaut has been designed. U. S. ELECTRICAL MOTORS, INC., 200 E. Slauson Ave., Los Angeles 54, Calif.
Circle Inform-A-Gram No. A15.

Lucifer Electric Furnaces feature newly designed electronic controls that permit heating and cooling rapidly or slowly, as desired. Any of these double-duty furnaces can be used for regular hardening, case hardening, drawing, tempering and other processes. The manufacturer is making a free trial offer of any one of this line to qualified furnace users.

For additional information and literature, write GILBERT S. SIMONSKI CO., 403 N. Broad St., Philadelphia 8, Pa.
Circle Inform-A-Gram No. A16.

CHICAGO DIES
Complete Line of
PUNCHING and FORMING DIES
for All Sizes and Makes of
PRESS BRAKES
DREIS & KRUMP
MANUFACTURING COMPANY
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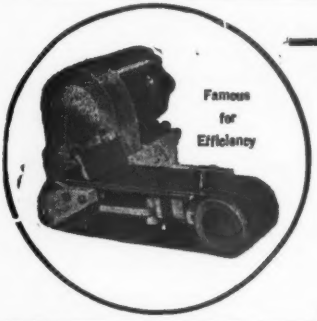
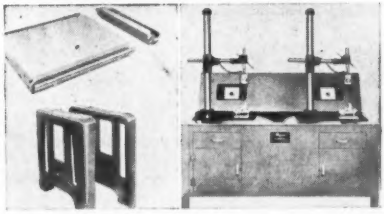
MOTOR MICA
TRADE MARK REG. U. S. PAT. OFF.
Anti-Friction Compound
IN WHITE POWDERED FORM
Cools hot bearings ● Solves toughest lubricating problems ● Saves wear on moving parts ● Works wonders with cutting oils ● Packed in 5-10-25 lb. containers. *Write for Free Sample. No Obligation.*
SCIENTIFIC LUBRICANTS CO.
3469 N. Clark St. Chicago 13, Ill.



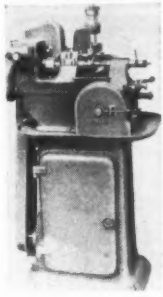
• *HIGH SPEED GRINDING* •
STANDARD D-4 ABRASIVE BAND GRINDER
This new, streamlined bench type grinder assures fast, quality finishing on metals, plastics, wood, fibre . . . at low cost. Built to machine tool specifications, Standard D-4 is equipped with improved band tension control and specially designed protective motor hood. 4x36¼" band. The ideal portable unit!
Other styles and sizes in New Manual on finishing — Write today
WALLS SALES CORP.
333 Nassau Avenue Brooklyn 22 New York

Low-cost, Rigid, Sectional Tables (below, left), for setting up special purpose machines or multiple spindle drill presses to fit your job, are announced by Delta Power Tool Division. Each table section is 23⅜" wide x 30" long and, with the addition of end sections, is increased to 35" long. With these table sections, you can build up any length table you desire. Adequate drain trough for carrying off coolant on wet cutting operations is provided. On these sections, any type Delta 17" or 14" drill press head can be easily installed. DELTA POWER TOOL DIV., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1, Wis.
Circle Inform-A-Gram No. A17.



This Twin Thomas Metalmaster Metal Disintegrator (above right) was made to the specifications of one of the large automobile companies and was installed as the key point of a conveyor line system. Motor blocks containing broken taps are moved on roller lines to each end of the Metalmaster. Taps are removed swiftly. One worker handles both machines without inconvenience or unnecessary hurry. Additional details on Thomas Metalmasters can be obtained from WARNER DIV., CLINTON MACHINE CO., 20263 Hoover Ave., Detroit, Mich.
Circle Inform-A-Gram No. A18.

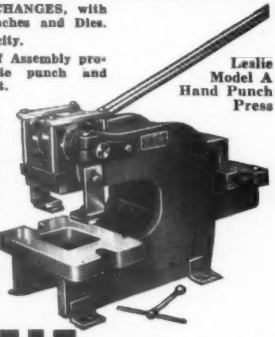
Lambert Type 75 Semi-Automatic Gear Hobbing Machine is now available from stock in the U. S. through Carl Hirschmann Co. This Swiss machine cuts gears with straight teeth, gears with teeth inclined up to a 180° angle, worm wheels (cut radially) and, with a special attachment, bevel gears with straight teeth. It features automatic and radial feed. This combination of movement considerably shortens the over-all stroke and the productivity capacity of the machine is accordingly increased. CARL HIRSCHMANN CO., 30 Park Ave., Manhasset, N. Y. **Circle No. A19.**



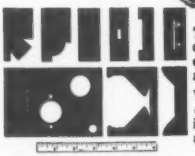
BLANKING, NOTCHING, PARTING, EMBOSSING

- **FAST DIE CHANGES, with standard Punches and Dies.**
- **15 Ton capacity.**
- **Patented Leaf Assembly provides accurate punch and die alignment.**
- **6" throat depth permits reaching to center of 12" piece.**
- **Large Punch Plate and Bed permits blanking over big areas.**

Diagram illustrates versatility of Press — each blanking done with 1 stroke.



Leslie Model A Hand Punch Press



Tool your jobs at low cost from our wide variety of standard punches and dies.

Write now for illustrated catalog and circular showing punches and dies available from stock.

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STOP WEAR on Die Sets

. . . with ACRO Pin Oilers

Acro Pin Oilers, as illustrated, fit over each leader pin and seals in place with a rubber neoprene washer. Each cup is filled with oil so each downward stroke brings bushing in contact with oil and each upward stroke distributes oil evenly over leader pins. Eliminates bushing wear, leader pin scoring, and maintains die accuracy.

Write for FREE Bulletin

describing Acro products
Ask for Bulletin TD-30.

ACRO Metal Stamping Co.

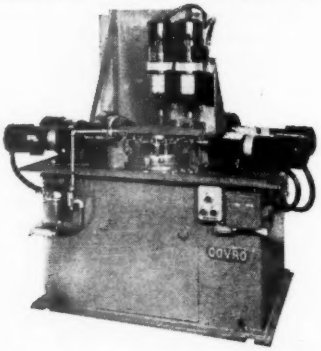
320 E. Reservoir Ave., Milwaukee 12, Wis.

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

The Cilco Hydraulic Diamond Turner, originally designed for Cincinnati Centerless Grinders, is now available for Landis Camamatic, I. W. and Heald Internal Grinders. On Heald Internal Grinders, this turner can be adjusted to 1/600 of one turn per dress, thereby elimi-

nating loss of size on precision internal grinding. CLEVELAND INDUSTRIAL TOOL CO., INC., 1080 E. 222nd St., Cleveland 17, Ohio. **Circle Inform-A-Gram No. A20.**

A New Govro-Nelson Machine automatically drills, reams, countersinks and taps a small part. Its production speed is such, for example, that on a small brass part requiring



eight of the above-mentioned operations, it does the work at the rate of 1200 pieces per hour. Seven Govro-Nelson drilling units and one Govro-Nelson tapping unit are employed. GOVRO-NELSON CO., 1933 Antoinette, Detroit, Mich.

Circle Inform-A-Gram No. A21.

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HAND-CUT
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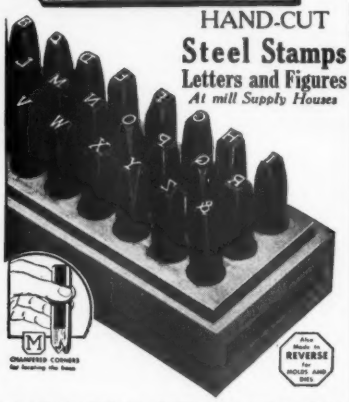

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Tail Stock
Turret
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up
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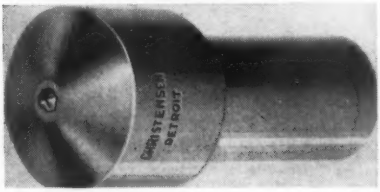
GROUND HSS BLANKS
Any decimal diameter to ½"—in any length.
Mirror finish surface to gage tolerance. Many
uses — punches, gages, measuring wires,
special tools, etc. Quick delivery.
Write for price list D-1.
WILLIAM T. HUTCHINSON COMPANY
235 Main St. Orange, N. J.

High-Precision Small Counterbores and Step Drills are now available through Woodruff & Stokes. By using one of these especially designed tools (a spiral fluted, double-ended step drill), a large manufacturer of electric meters was able to perform three operations at one station. All these tools have tolerances of .0002" on diameter and .0003" on eccentricity. They are made of carbon or high speed steel or special steel alloys. Write WOODRUFF & STOKES CO., INC., 349 Lincoln St., Hingham, Mass., for complete details.
Circle Inform-A-Gram No. A22.

Single-Point Diamond Wheel Dressing Tools. This new Christensen line is now being made in a full range of sizes for all grits of grinding wheels. They feature an exclusive "C-Metal" mounting method for holding the stone, which assures that the diamond will always



hold its setting regardless of vibration or the intensity of alternate heating and cooling caused by frequent wheel applications. CHRISTENSEN DIAMOND TOOL CO., Dept. AX, 9607 Traverse St., Detroit 13, Mich.
Circle Inform-A-Gram No. A23.

Three New Tyler 15" Band Saw Models are announced. The new units provide speed ranges from 80 to 5000 fpm by a handcrank. Exclusive Tyler upper band wheel adjustment pivots about point at top center of wheel as shown in upper illustration. On other band saws, upper wheel pivot point is located near axis and in back of wheel, tending to throw top side of wheel in or out, as in lower drawing. TYLER MFG. CO., INC., 1005 W. Arbor Vitae, Inglewood, Calif., will send data.

Inform-A-Gram A24.

INCREASE PRODUCTION
REDUCE COSTS
DURANT ROLL FEEDS

Accurate Feeding
Reversible
Easy to Install
Highest quality
Immediate delivery

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155 ORANGE ST., PROVIDENCE 3, R. I.

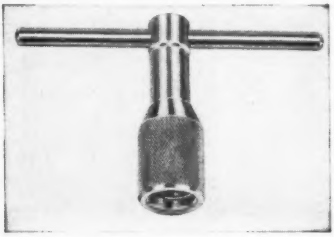
Precision Die Made—Lowest Possible Cost.
DAYTON ROGERS MFG. CO., Minneapolis 7, Minn.

HARDNESS TESTING
has been done with the
SCLEROSCOPE
since 1907

THE SHORE INSTRUMENT & MFG. CO., INC.
9025 Van Wyck Avenue
Jamaica 2, N. Y.

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

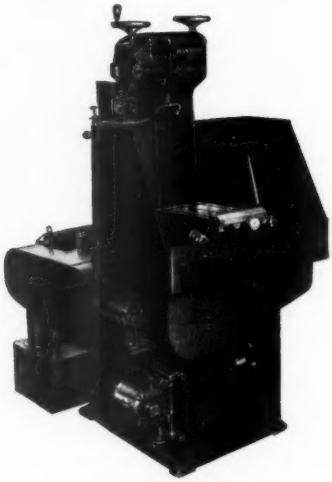
The New Dahlstrom Tap Wrench has a place for occasional use in every shop although it is not intended for a large volume of tapping work. Designed for quick changes of taps by using Dahlstrom Tap Adaptors, it accommodates taps in sizes from 8-32 to ¾".



Of polished steel, it weighs 6½ oz. This tap wrench fits neatly into a mechanic's tool kit. DAHLSTROM MFG. CO., 2508 W. Larpenteur Ave., St. Paul 8, Minn.

Circle Inform-A-Gram No. A25.

A Heavy-Duty 8" Wet Abrasive Belt Grinder has been added to the line of Hammond of Kalamazoo. Model V8-WP features a new patented Power Reciprocating Table with Tilting Workholder and a Water Cooled Belt Platen. It is designed for production finishing and surfacing parts of non-ferrous, ceramic, plastic, and thin ferrous parts. HAMMOND MACHINERY BUILDERS, INC., 1631 Douglas



Ave., Kalamazoo, Mich., can supply details.

Circle Inform-A-Gram No. A26.

SAVE
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STOP-PINS
AVAILABLE IN 5 SIZES

FINGER STOPS
IN 3 SIZES

STOP-PINS are complete self contained units that hold securely in stripper plate. All sizes have 1/32" wall permitting insertion close to die or punch. No threads inside STOPS for springs to catch on. Write for literature and prices. SUPEREAM FINGER STOPS made in uniform width to fit any standard width slot. Just grind ends to fit. Write for literature.

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SAVE ON PRODUCTION TOOLING COSTS with
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The exclusive, quick-acting clamping mechanism of SPEED VISE accommodates a wide variety of parts.
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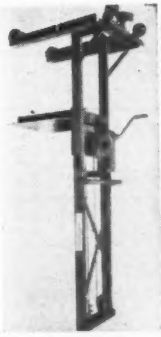
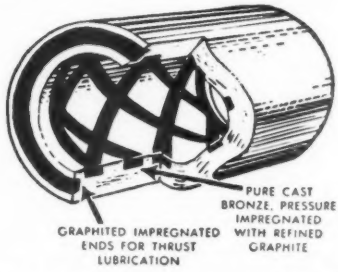
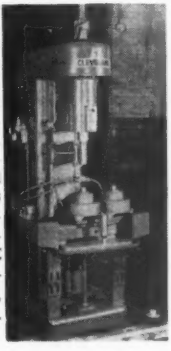


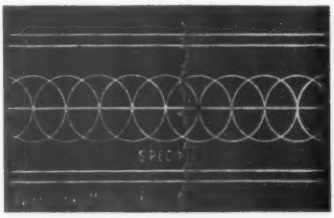
The Portable Elevator pictured is an addition to the Barrett "5-Hundred" Line, with a full 7-foot lift, as compared with the 5-foot lift of the regular "5-Hundred" model. The 7-foot lift increases the height to which materials can be piled. Applications include placing die in machines or racks and overhead maintenance jobs. BARRETT-CRAVENS CO., 4609 S. Western Blvd., Chicago 9, Ill.
Inform-A-Gram No. A27.

"GOPI" Graphited Oil-Less Bearings and Bushings have been introduced by Bronze Bearings, Inc. The cutaway sketch shows the manner of impregnating pure bronze bearings and bushings with a highly refined graphite to obtain a constant film of lubrication from shaft motion. For details write BRONZE BEARINGS, INC., 668 North Ave. East, Cranford, N. J.
Circle Inform-A-Gram No. A28.



A Substantial Number of these Model E-4U Cleveland Lead Screw Production Machines are turning out 3.5 Rocket Bodies at the rate of 100 pieces per hour in various munition plants. This tapper is fully automatic in operation except for loading and unloading. The fixture is the shuttle type and is air operated. THE CLEVELAND TAPPING MACHINE CO., subsidiary of Automatic Steel Products, Inc., Dept. T&P, Canton 6, Ohio.
Inform-A-Gram No. A29.





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STOPS LOSSES
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Simply brush on; ready for the layout in a few minutes. The dark blue background makes the layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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"M" TEMPER ALLOY STEEL

for maximum machinability and minimum heat-treat distortion. It has great toughness at high degrees of hardness and long-wearing properties for lowest unit cost. For complete information on HY-TEN alloy steels, write for FREE DATA BOOK.

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Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings.

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Production Engineering
Complete Plant Routing and Tooling

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2067 W. 55th St., Cleveland, O., WOodbine 4786. Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

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PRECISION DIES, JIGS & FIXTURES
Quality Stampings
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NOBLE & STANTON, INC.
993 Broadway, Bedford, Ohio, Bedford 1234. Tool Makers—Short Run Production Work.

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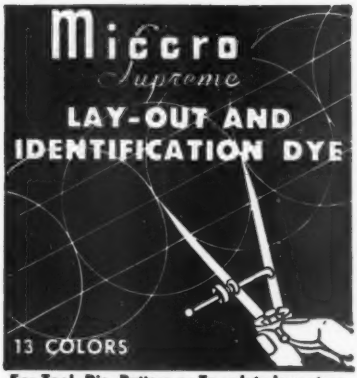
2711 Church Ave., Cleveland, O., CHerry 1048 Contract Grinding, Boring and Planing. Lester-Phoenix Die Casting and Plastic Molding Machines.

A. P. SCHRANER & CO.
3338 Payne Ave., Cleveland, O., HEnderson 3644. External Cylindrical Lapping Machines, Special Machinery, Tools, Dies, Jigs, Fixtures.



For Tool, Die, Pattern or Template layout on metal . . . Quick identification of bar stock, sheet, strips or parts . . . Shows up in sharp relief—dries instantly . . . Write for sample and circular on company letterhead.

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Flexolap... INSTANTLY AND ACCURATELY

ADJUSTABLE FOR FAST CUTTING AND POLISHING

...without danger of galling or seizing!

The Flexolap barrel is made with a series of longitudinal slots milled "off-center" to permit sensitively flexible expansion up to 15% — or more — under pressure of the adjusting pin. This construction enables Flexolap to save valuable time and to lap rounder, straighter holes. For accurate precision take-up, as desired, to maintain size and compensate for wear on barrel . . . simply turn adjustment screw.

Illustrated at left is Set No. 1. Six sizes (3/16", 1/4", 5/16", 3/8", 7/16" and 1/2") with six brass and six steel barrels on wood stand, complete.....**$12.75**

Also available in sizes 7/32", 9/32", 11/32", 13/32", 15/32", 5/8", 11/16" and 3/4". For lapping holes smaller than 3/16", use the *Midget Lap*. Seventeen sizes: .032, .036, .040, .046, .054, .062, .070, .079, .090, .104, .120, .135, .155, .170, .187, .218, and .250. Trial assortment (17 laps).....**$1.95**

Write today for complete particulars

FEDERAL TOOL CORP. 3600 Pratt Blvd., Chicago 45, U.S.A.

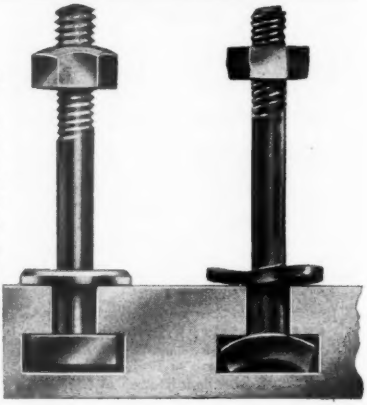
SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

BOYAR-SCHULTZ SMB SPECIAL MACHINE BOLTS

EVERY mechanic knows the damage done to the accuracy of costly machine tools when soft, poorly made bolts are used on the T-Slots of machine beds.

Boyar-Schultz SMB Bolts are made from upset forgings of alloy steel, heat treated for maximum properties. They are precision machined with heads at right angle to the body. This presents a flat bearing surface to T-Slots.

For best results, use SMB Nuts and Washers. They are specially made to work with Boyar-Schultz SMB Bolts.



The SMB Bolt at left shows how the clean, flat surface of the head fits the T-Slot. Bolts made of soft materials are quickly distorted and break down the machined surfaces, destroying accuracy.

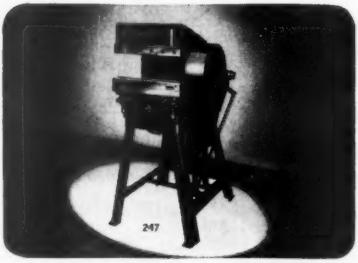
BOYAR-SCHULTZ CORPORATION, 2112 WALNUT STREET CHICAGO 12, ILLINOIS

WHITNEY - JENSEN PRODUCTS
41 YEARS EXPERIENCE

No. 247—18" PRESS BRAKE

Production shops turning out quantities of small formings in large presses and job shops requiring a small brake, will find the No. 247 a cost reducing, space-saving piece of equipment. Capacity of the machine is 14 ga. mild steel over ⅞" 90° V die or 4½ tons.

Strokes per minute—47
Throat Depth— 6¼"
Throat Height—11½"



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WHITNEY METAL TOOL COMPANY
724 FORBES STREET • ROCKFORD, ILLINOIS

A Report on Wax as a Metal Working Lubricant

Current production tests are pointing to a bright future for some waxes as metal working lubricants.

These tests, conducted in a variety of metal working manufacturing plants, show that special blends of waxes used in place of conventional lubricants permit the drawing of stainless steel far beyond its theoretical capacity. They may also serve as a replacement for the copper flashing on stainless steel wire used for cold heading. Wax blends are also proving useful in the drawing of aluminum. Metal fabricators find that the use of wax as a lubricant extends the life of tools and dies and in some cases completely eliminates degreasing.

A large electrical manufacturing plant using waxes as a drawing lubricant found that blanks of #405 stainless steel can be successfully drawn 50% beyond the theoretical capacity of the metal. After a production run of over 2,000 pieces, the tool wear was so slight that it could not be determined with standard measuring devices.

The same wax material is successfully being used as a lubricant for various cold heading operations. The wax can be applied to the coil of wire either by dipping it into the wax solution and allowing it to dry or it may be applied just before the wire enters the cold heading machine. When square shoulders are involved in the upsetting operations, they fill in far better when wax is used as a lubricant.

Other cold heading tests on stainless steel wire are being aimed at the elimination of copper flashing normally applied to wire for lubrications. Although incomplete, these tests offer sufficient evidence that the use of wax as a lubricant may make the copper flashing step unnecessary.

Other discoveries were made by Johnson's Wax in collaboration with a large wire manufacturer and a firm making wheel bolts. In the wire mill, extensive experiments were conducted with a specially prepared paste type wax. The wax was used to coat wire in the die box, incorporating aluminum stearates as a coagulant with a small concentration of lime. As a result of this procedure, a dry wax film was applied to the wire which minimized lime flaking and provided a finish that offers considerable resistance to corrosion caused by moisture condensation during storage.

Over 150 tons of this specially finished wire has been upset for automotive wheel bolts and is now being specified by the bolt manufacturer.

Still another use for wax in metal fabricating has been adopted by a screw manufacturer after it was determined the torque of self tapping metal screws could be reduced by 50% if the screws were given a coating of the special wax blend.

The versatility of waxes as lubricants has also become apparent in other metal working operations. For example, a major aircraft company is successfully using wax as a lubricant in the shoe bending of a hard alloy tube. Wax not only reduces the bending pressures from four tons to two and one-half tons, but also materially reduces the loss from crimping and buckling.

★ ★ ★ ★ ★ ★

Modern Abrasives Motion Picture

"Grits That Grind," a new Norton Company color motion picture on abrasives and grinding wheel manufacture, is now ready for immediate showing.

It is a 30-minute, 16 mm. film showing step-by-step manufacturing processes from mining bauxite in Arkansas to the finished product in Worcester: aluminum oxide and silicon carbide grinding wheels.

The film also touches on other Norton products such as grinding machines, refractories, pulpstones, sandpaper, sharpening stones, porous mediums, non-slip floors and tile, and wear-resistant products.

This new film is now available free of charge on loan by writing to "Grits That Grind," Norton Company, Worcester 6, Mass. Copies may also be purchased.

Dividing Engine Installation

The 106-year-old manufacturer of engineering and surveying instruments, W. & L. E. Gurley, of Troy, N. Y., has installed two dividing engines capable of marking circular divisions within an accuracy of less than one second of arc.

The machines were built by the Societe Genevoise d'Instruments de Physique (S.I.P.), of Geneva, Switzerland, who supplied similar machines to the National Bureau of Standards, Bell Telephone Laboratories and the U. S. Navy Laboratories. Gurley uses the precision equiption. The installations thus "float" and military instruments.

Shock-proof mounting had to be provided in order to insure the extreme accuracy of which the machines are capable. They rest on blocks of concrete supported by coil springs which are placed, in turn, in a concrete foundation. The installation thus "floats" and are independent of all vibrations.

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PIPE THREAD
Inspection Charts
For Optical Comparators
★ The only quick, positive method for inspection of taper pipe thread tools and production work.
★ Conforms to S. A. E.—H-28 specifications.
★ Available in all pitches at 31.25X, 50X and 62.5X.
WRITE FOR LIST AND PRICES
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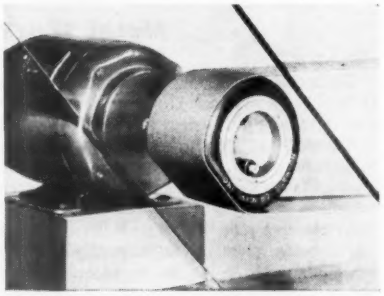
Battle Creek, Mich.



A Flat Tire— on purpose

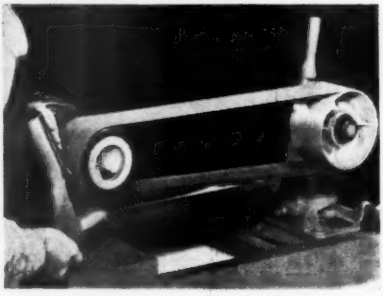
A piece of plate glass as illustrated above, pressed against an abrasive belt driven by a Nu-Matic wheel shows how this new setup presents up to ten times more grinding surface to the work.

The Nu-Matic wheel is a pneumatic drum which can be inflated to pressures appropriate to a great variety of jobs. The combination of different drum pressures with the various abrasive belt grits permits meeting a wide range of surface finish requirements.

The cushion effect of the resilient inflated wheel results in greatly increased life of abrasive belts and bands; there being less wear and tear than with a hard wheel.

This resiliency of contact between the workpiece and the Nu-Matic wheel means that the operator is less likely to exceed the pressure permissible for a given workpiece and for a prescribed finish. Accordingly, users have reported less scrap and rework.

For details and specifications circle **Inform-A-Gram No. D10.**



HAND TAPPING *with* MACHINE PRECISION

Adapts for LATHE USE

59.50 F. O. B. ST. PAUL

Just slip a tap adapter into the Dahlstrom Tap Guide and twist. Your hand tapping will be quick and accurate. For machine tapping, the spindle top is center-bored to fit the tail stock center of a lathe. Size 13"x8"x14". Includes 9 adapters (8/32 to 3/4"). Taps not furnished. Dahlstrom Mfg. Co., 2508 W. Larpenteur, St. Paul 8, Minn. **Write for Pamphlet.**

Dahlstrom TAP GUIDE

ONE Tool

ONE Set Up

. . . for boring, facing, turn-recessing, undercutting

Another NEW "MASTER TOOL"

THE UNIVERSAL "MASTERHEAD"

Featuring: automatic feeds, end release and return; adjustable stop; adaptable to all standard machines; highest precision; ideal for jig borers; seven models for work up to 24" diameter.

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381-4th Ave., Dept. TP, N. Y. 16, N. Y.

SOLD THRU LEADING SUPPLY HOUSES

GROBET CHATTERLESS COUNTERSINKS

Six staggered cutting edges give shearing cut that eliminates all chatter.

Send for catalog AC1.

GROBET FILE CO. of AMERICA, INC.

421 Canal Street N. Y. 13, N. Y.

"HI-ROCKWELL" DRILLS

DRILL, CLEAN, BRIGHT, ACCURATE HOLES IN

HARDENED STEELS

WITH A ROCKWELL HARDNESS OF C45 to C68

OUR FREE BOOKLET TELLS HOW

●

ALL DRILLS SHIPPED FROM STOCK

●

CHAMPION TOOL CO.

BOX 463

FARMINGTON, MICHIGAN

●

We also manufacture the NU-MIKRO piston grooving tool.

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

. . . Apprentice Training, from page 68
quired, he is given additional training until he has overcome his weakness. No set time is given for the various assignments, and a trainee is advanced in accordance with his initiative and ability.

After a machinist apprentice has completed all the required assignments, he is segregated for further training as a machinist, machinist repairman, toolmaker, diemaker, moldmaker, or metal patternmaker; and is then transferred to an actual work area in the plant to complete his apprenticeship.

All apprentices receive at least four (4) hours related training weekly throughout their entire apprenticeship. Apprentices in the metal working trades are given related training in applied mathematics; shop theory; applied algebra; geometry; trigonometry; chemistry of materials; physics; mechanics; industrial economics; English; blueprint reading; tool, jig, die, and machine design. The instructors are competent journeymen, and have had university training in teaching. Each related training instructor is also responsible for the apprentices' training in a specific work area of the manufacturing plant after they have been transferred from the Training Section. The related instructions are divided into three terms a year of sixteen to seventeen weeks each.

A trainee's foreman or shop instructor reports on the apprentice's progress on his shop assignment on monthly rating forms, and this information is recorded.

A moldmaker apprentice is pictured filing a permanent mold in the Tool Room.

This required assignment in the Training Section consists of straddle milling a fixture on a universal milling machine.

The monthly rating forms are given to the apprentice, who is encouraged to discuss his progress with his shop foreman, his instructor, or the supervisor of apprentices. The apprentice is given a rating at the completion of each term of related training and a yearly rating of "A", "B", "C", or "D", covering his complete training progress for the year. A "D" rating automatically drops a boy from his apprenticeship. Each boy's parents or guardian are notified by letter of his yearly rating. Less than one per cent of the boys leave the Company before completion of their training, and over ninety-five per cent of the graduate apprentices remain with Westinghouse after completing their training.

For each yearly "A" grade, a trainee receives a time credit of two hundred (200) hours. If he maintains a straight "A" rating for his entire apprenticeship, he is given an additional time credit of two hundred and fifty (250) hours enabling him to complete his apprenticeship in 3½ years instead of 4 years.

Our philosophy of training is that the training of a boy may start with his hands, but it must also include his head

and his heart; the three basic elements. Every activity associated with our Trades Training program is conscientiously directed toward the development of one or more of this important trio.

Modern industry cannot afford to ignore the habits of its employees both during and after working hours. Conduct is a sure index to character. The human behavior mirrors the inner man. Industry must be interested in high quality of character if for no other reason than the maintenance of morale.

When consideration is given to the fact that a boy devotes more time to the performance of his work than to any other activity in his daily life, one realizes that a boy's work is a very definite influence in the building of his character. "As you sew, so shall you reap!"

We encourage our boys to take an active part in their community, civic, and church affairs. We want them to be good loyal citizens of our Country. We believe that only men of strong character can build products of character, and that one must train the heart as well as the head and hand.

A diemaker apprentice is checking punches in a compound die with a vernier caliper after setting them.

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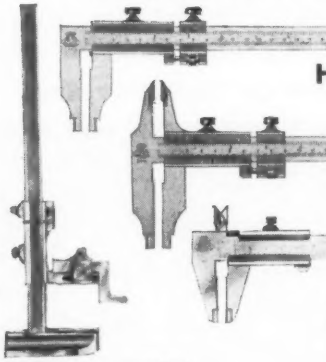

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Height Gage supplied
with tungsten carbide tip

ALINA CORPORATION—32 Broadway, New York 4, N. Y.

SEE ADVERTISERS INDEX, PAGE 103, FOR KEY NUMBERS

. . . Platstics, from page 113

(200-500 p.s.i.) can be obtained and are entirely practical where prying, peeling or shock loading is negligible.

2. The only really strong cemented joint design is that of one tubular section pressed into another, where only pure shear loads are possible.

3. Surfaces to be bonded should be lightly sandblasted (or very carefully and thoroughly sanded, or machined) prior to cementing, since very little bond is obtained against a plain as-molded surface.

4. Bonds to metal are generally very poor unless mechanical gripping can be designed into the joint.

5. Polyester resins appear to work as well as any other adhesives on polyester laminates.

6. Thin glue lines are very desirable for best strength.

7. Much work remains to be done on the subject of adhesives and the above observations may be thrown into a cocked hat by new discoveries at any time, but basically the strength of a Fiberglas laminate derives largely from the relatively long glass fibers which reinforce it, and no cemented joint can possibly produce a continuous flow of these fibers through and across the joint itself.

Part:	Washing Machine Balance Ring
for:	Apex Montgomery Ward Automatic Washer
by:	Apex Electric Co.
size:	3/32 thick x 24" dia.
Operation:	Fly cutting
rate:	50 r.p.m., 310 ft./min.; 35 pcs./hr.
lot:	2000 pcs.
to date:	25,000 pcs.
Machine:	Van Norman Miller
Tool:	Carboloy faced lathe bit
Life:	500 pcs., 3000 lineal ft. per sharpen
Finish:	Sharp & clean one edge, scrap piece some fuzz
Lubrication:	Dry
Accuracy:	Plus or minus .010" dia.

★ ★ ★ ★ ★ ★

Machine Time Cut One-Third In Shaft Turning

Total machining time on this heavy shaft turning job was reduced by 52 minutes (from 168 to 116 minutes) by using carbide tools. On the longest roughing cut the shaft diameter is now reduced a full inch with one pass.

The shaft is turned from 5-inch diameter, SAE 1035 steel; the first cut reduces the O.D. to 4 inches. Tools are tipped with standard Carboloy blanks, grade 78B. Speed and feed for the roughing pass is 307 sfm at .015" feed. Although this speed is in excess of normal carbide practice, tool life is very satisfactory for the small job-lot quantities being machined at one time.

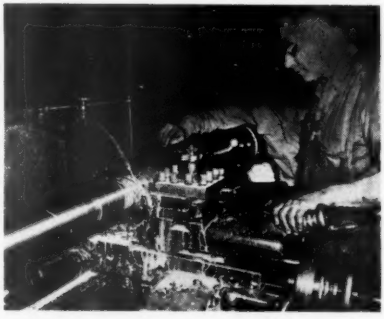

Photo courtesy Carboloy Company, Inc.

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- PERFECT LOAD-CENTERING ACTION aligns the load every time. Eliminates strain on threads which causes ordinary eye bolts to break off. Heavy objects (machinery, tools, dies, etc.) can be moved safely . . . moved faster . . .intermittently jerked without fear of bolt shearing off. Made from high grade ductile steel. Prompt delivery on stock sizes. Special sizes on quotation:
  - ½" to ⅝" — $11.75 each
  - ¾" — $13.50 each
  - ⅞" to 1" — $23.50 each
- When ordering specify quantity and thread size.

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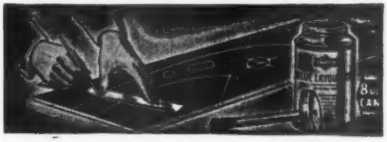

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$32.50

MASTER APPLIANCE MFG. CO., 4th at Ontario, Racine, Wisconsin

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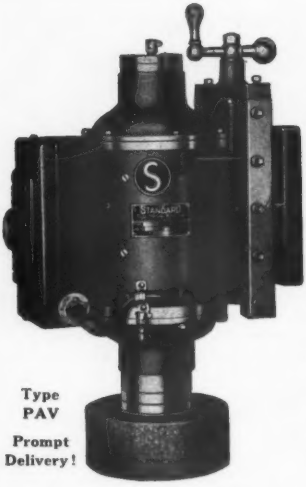

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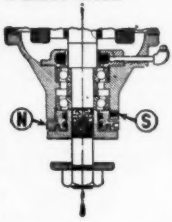
MAKE YOUR MACHINES "DOUBLE PURPOSE" MACHINES!

The Standard Verticle Spindle Grinder is made in sizes from ½ H.P. to 25 H.P. Speeds of 1200, 1800 or 3600 R.P.M. for cup or plate mounted cylinder type of wheel. **Ideal for application to Planers, Boring Mills, Shapers, Milling Machines, etc.** With or without feeds.

This sectional view illustrates a creation of Standard's engineers — evidence that you receive more when you buy a Standard tool. Sectional view of thrust bearing construction on all Standard modern Vertical Spindle and Double End Disc Grinders.



Threaded Nut "N" permits fractional thousandths adjustment by releasing Set Screw "S" to take up wear on bearings without removing wheel—no shims involved.

WRITE FOR CATALOG 44 TODAY

The Standard Electrical Tool Co. Mt. Hope & Sixth St., Cincinnati 4, O.

.0005 HOLE LOCATION IN 3 MINUTES

YOU NEED THIS TOOL EVERY TIME YOU USE A DRILL CHUCK or BORING HEAD in a VERTICAL MILL, HORIZONTAL MILL or JIG BORER, if the hole is located from a surface that has been machined.

$10.00
With Case

This toolmaker's wiggler rotates in the machine spindle from 300 to 1000 R. P. M. and is held in a ⅝" collet.

- NO DOUBT WHEN LOCATION IS REACHED—The lower half jumps sideways .0005" and continues to rotate there when location is reached. This occurs at the same dial graduation every time.
- NO EYESTRAIN—Location can be seen easily with average light. A source of light is not needed behind this wiggler.
- SHORT DISTANCE REQUIRED FROM WORK TO MACHINE SPINDLE—This wiggler permits the use of short tools without readjusting the machine because its length is only 2¾".
- LOCATES FROM FLAT OR ROUND SURFACE.
- LOCATES FROM STEP ONLY .010" HIGH.
- IDEAL TOOL for LOCATING HOLES IN DRILL JIGS, DIES, TOOLS and MACHINE PARTS.
- LOCATION IN 3 MINUTES will make possible the machining of a hole, in the same location, in any number of pieces. This can be accomplished by using a stop on the machine vise.
- MADE FROM HARDENED TOOL STEEL WITH ALL SURFACES GROUND.
- YEARS OF ACCURATE USE CAN BE EXPECTED from this tool with proper care. A well known aircraft manufacturer has more than 70 of these toolmaker's wigglers in use.

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DUMORE DRILL HEAD GIVES 97% COST REDUCTION ON TOUGH JOB

"Saving on first 4½ hours production on this one operation, repaid the cost of the drill head," says Harold Forsmark, Chief Engineer of Stiger Precision Products, Inc., Cicero, Illinois.

OLD WAY — $.385 per piece

Problem was to drill 2 tie-wire holes at an angle thru 1"x1"x½" stainless steel nut of 15 - 20 Rockwell hardness with a No. 50 drill. Maximum production with hand-fed press was 10 pieces an hour and operator broke from 14 - 18 drills per day at a cost of 20c per drill.

DUMORE WAY — $.0117 per piece

With the Dumore Drill Head, Stiger gets 120 pieces an hour and has eliminated drill breakage and scrap loss. Says Forsmark, "We set the pressure and the compressed air chamber of the Dumore Drill Head controls it automatically and changes feed and speed to match the material. This means the drill head 'walks' right down."

If you're using No. 80 to ⅛" drills, it will pay you to get the facts on the New Dumore Automatic Drill Head. Call your Dumore Distributor today for a demonstration. Free 16-page bulletin on request.

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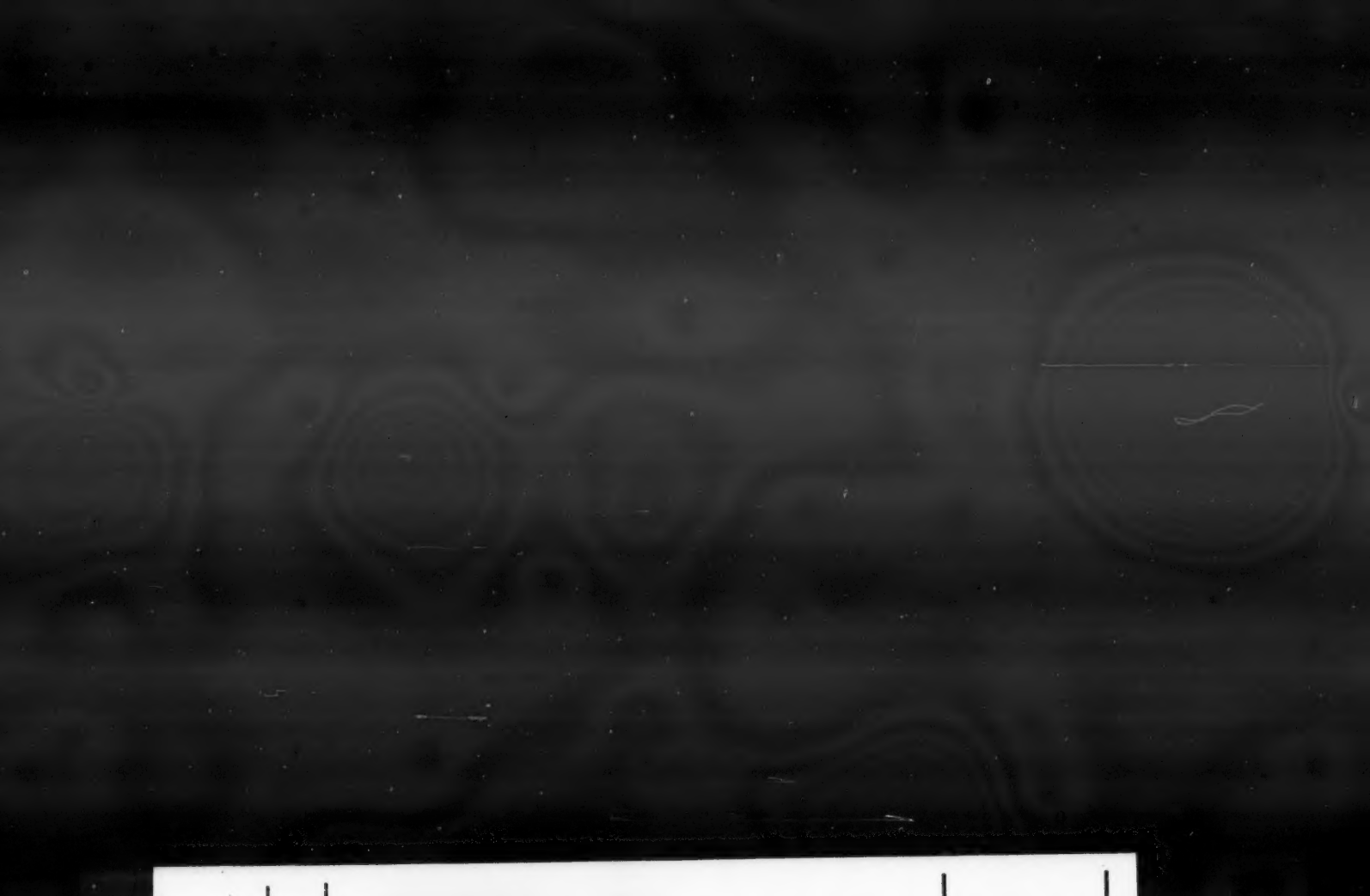
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